

**EPA Superfund
Record of Decision:**

**BUNKER HILL MINING & METALLURGICAL
COMPLEX
EPA ID: IDD048340921
OU 01
SMELTERVILLE, ID
08/30/1991**

AUGUST 26, 1991
DIRECTOR
IDAHO DEPARTMENT OF HEALTH AND WELFARE

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REGIONAL ADMINISTRATOR
USEPA REGION 10

DATE: AUGUST 30, 1991

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1.0 SITE DESCRIPTION

THE BUNKER HILL MINING AND METALLURGICAL COMPLEX SUPERFUND SITE IS LOCATED IN SHOSHONE COUNTY, IN NORTHERN IDAHO, AT 47 DEGREES 05' NORTH LATITUDE AND 116 DEGREES 10' WEST LONGITUDE (FIGURE 1-1). THE SITE LIES IN THE SILVER VALLEY OF THE SOUTH FORK OF THE COEUR D'AIENE RIVER (SFCDR). THE SILVER VALLEY IS A STEEP MOUNTAIN VALLEY THAT TRENDS FROM EAST TO WEST INTERSTATE HIGHWAY 90 CROSSES THROUGH THE VALLEY, APPROXIMATELY PARALLEL TO THE SFCDR. THE SITE INCLUDES THE TOWN OF PINEHURST ON THE WEST AND THE TOWN OF KELLOGG ON THE EAST (FIGURE 1-2) AND IS CENTERED ON THE BUNKER HILL INDUSTRIAL COMPLEX. THE SITE HAS BEEN IMPACTED BY OVER 100 YEARS OF MINING AND 65 YEARS OF SMELTING ACTIVITY. THE COMPLEX OCCUPIES SEVERAL HUNDRED ACRES IN THE CENTER OF THE SITE BETWEEN THE TOWNS OF KELLOGG AND SMELTERVILLE.

THE AGENCIES US ENVIRONMENTAL PROTECTION AGENCY (USEPA) AND IDAHO DEPARTMENT OF HEALTH AND WELFARE (IDHW) HAVE DESIGNATED A 21-SQUARE-MILE STUDY AREA FOR PURPOSES OF CONDUCTING THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), WHICH HAS BEEN DIVIDED INTO POPULATED AREAS AND NON-POPULATED AREAS. THIS RECORD OF DECISION (ROD) ADDRESSES CONTAMINATED RESIDENTIAL SOILS WITHIN THE POPULATED AREAS OF THE SITE. SOILS THROUGHOUT THE SITE HAVE BEEN CONTAMINATED BY HEAVY METALS, TO VARYING DEGREES, THROUGH A COMBINATION OF AIRBORNE PARTICULATE DEPOSITION, ALLUVIAL DEPOSITION OF TAILINGS DUMPED INTO THE RIVER BY MINING ACTIVITY, AND CONTAMINANT MIGRATION FROM ONSITE SOURCES. ONSITE SOURCES INCLUDE THE INDUSTRIAL COMPLEX, TAILINGS AND OTHER WASTE PILES, BARREN HILLSIDES, AND FUGITIVE DUST SOURCE AREAS LOCATED THROUGHOUT THE SITE.

THE POPULATED AREAS OF THE SITE CONSIST OF FOUR INCORPORATED COMMUNITIES AND THREE UNINCORPORATED RESIDENTIAL AREAS. EXCEPT FOR THE EASTERN PORTION OF KELLOGG, ALL OF THESE COMMUNITIES LIE SOUTH OF US INTERSTATE 90(I-90), BETWEEN THE HIGHWAY AND STEEP HILLSIDES TO THE SOUTH PORTIONS OF THE RESIDENTIAL AREAS LIE WITHIN THE FLOODPLAIN OF THE SOUTH FORK OF THE COEUR D'ALENE RIVER.

THIS ROD ADDRESSES CURRENTLY ESTABLISHED RESIDENTIAL AREAS. THE CITY OF KELLOGG (SEE FIGURE 1-3) IS SIX MILES EAST OF THE WESTERN EDGE OF THE SITE AND APPROXIMATELY ONE MILE EAST OF THE SMELTER COMPLEX. THE POPULATION IS ESTIMATED TO BE 2,600 WITH ABOUT 1,100 RESIDENCES. THE NEXT LARGEST POPULATION CENTER IS THE CITY OF PINEHURST (SEE FIGURE 1-4) WITH 700 RESIDENCES AND ABOUT 1,700 PEOPLE. IT IS LOCATED ON THE WESTERN EDGE OF THE SITE, ABOUT ONE MILE SOUTH OF I-90. SMELTERVILLE (SEE FIGURE 1-5), WITH A POPULATION OF ABOUT 450 AND 270 RESIDENCES, IS APPROXIMATELY THREE MILES EAST OF THE WESTERN EDGE OF THE SITE AND LIES ALONG A MINOR ARTERIAL ROAD LINKING IT TO PINEHURST AND KELLOGG. THE TOWN IS ABOUT ONE MILE WEST OF THE SMELTER COMPLEX. THE CITY OF WARDNER (SEE FIGURE 1-6) IS CONTIGUOUS WITH THE SOUTHEAST PORTION OF KELLOGG AND IS APPROXIMATELY SIX MILES EAST OF THE WESTERN BOUNDARY OF THE SITE. THE POPULATION OF WARDNER IS CURRENTLY ABOUT 300 PEOPLE WITH 130 RESIDENCES. THE UNINCORPORATED COMMUNITY OF PAGE (SEE FIGURE 1-7) IS ABOUT 1 MILE EAST OF THE WESTERN EDGE OF THE SITE. MOST OF THE LAND IS OWNED BY AMERICAN SMELTING AND REFINING COMPANY (ASARCO), WHILE THE HOMES ARE OWNED BY THE RESIDENTS. POPULATION OF PAGE IS ESTIMATED TO BE ABOUT 100 TO 150 PEOPLE, AND THE AREA INCLUDES 65 RESIDENCES. TWO UNINCORPORATED RESIDENTIAL AREAS LOCATED ALONG THE EASTERN SITE BOUNDARY ARE ELIZABETH PARK AND ROSS RANCH WITH POPULATIONS ESTIMATED TO BE 120 AND 50 PEOPLE, RESPECTIVELY.

#SHEA

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

THE BUNKER HILL SUPERFUND SITE IS PART OF THE COEUR D'ALENE MINING DISTRICT LOCATED IN NORTHERN IDAHO AND WESTERN MONTANA. GOLD WAS FIRST DISCOVERED IN THE DISTRICT IN 1883. THE FIRST MILL FOR PROCESSING LEAD AND SILVER ORES AT THE BUNKER HILL SITE WAS CONSTRUCTED IN 1886 AND HAD A CAPACITY OF 100 TONS OF RAW ORE PER DAY. OTHER MILLS SUBSEQUENTLY WERE BUILT AT THE SITE AND THE MILLING CAPACITY ULTIMATELY REACHED 2,500 TONS PAR DAY.

THE KELLOGG-BASED BUNKER HILL AND SULLIVAN MINING COMPANY, INCORPORATED IN 1887, WAS THE ORIGINAL OWNER AND OPERATOR OF THE BUNKER HILL COMPLEX. IN 1956, THE NAME WAS CHANGED TO THE BUNKER HILL COMPANY AND IN 1968, GULF RESOURCES AND CHEMICAL COMPANY OF HOUSTON, TEXAS, PURCHASED THE COMPANY AND OPERATED THE SMELTER UNTIL IT WAS CLOSED IN LATE 1981. THE COMPLEX WAS PURCHASED IN 1982 BY THE BUNKER LIMITED PARTNERSHIP (BLP), HEADQUARTERED IN KELLOGG, IDAHO. BI-P SUBSEQUENTLY SOLD PORTIONS OF THE COMPLEX PROPERTIES TO SEVERAL RELATED OR AFFILIATED ENTITIES INCLUDING:

- ! SYRINGE MINERALS CORPORATION
- ! CRESCENT MINE
- ! BUNKER KILL MINING COMPANY (US), INC.
- ! MINERALS CORPORATION OF IDAHO

THE BUNKER MINING COMPANY RESUMED MINING AND MILLING OPERATIONS IN 1988 AND SUBSEQUENTLY CEASED THOSE OPERATIONS IN 1991.

THE BUNKER HILL AND SULLIVAN MINING COMPANY WAS ORIGINALLY INVOLVED ONLY IN MINING AND MILLING LEAD AND SILVER ORES FROM LOCAL MINES. FROM 1886 UNTIL 1917, THE LEAD AND SILVER CONCENTRATES PRODUCED AT THE SITE WERE SHIPPED TO OFFSITE SMELTERS FOR PROCESSING. CONSTRUCTION OF THE LEAD SMELTER BEGAN IN 1916 AND THE FIRST BLAST FURNACE WENT ONLINE IN 1917. OVER THE YEARS, THE SMELTER WAS EXPANDED AND MODIFIED. AT THE TIME OF ITS CLOSURE IN 1981, THE LEAD SMELTER HAD A CAPACITY OF OVER 300 TONS OF METALLIC LEAD PER DAY. AN ELECTROLYTIC ZINC PLANT WAS PUT INTO PRODUCTION AT THE SITE IN 1928. TWO SULFURIC ACID PLANTS WERE ADDED TO THE ZINC FACILITIES IN 1954 AND 1966, AND ONE SULFURIC ACID PLANT WAS ADDED TO THE LEAD COMPLEX IN 1970. WHEN IT WAS CLOSED IN 1981, THE ZINC PLANT'S CAPACITY WAS APPROXIMATELY 285 TONS PER DAY OF CAST ZINC. A PHOSPHORIC ACID PLANT WAS CONSTRUCTED AT THE SITE IN 1960 AND A FERTILIZER PLANT WAS BUILT IN 1965. THE PRIMARY PRODUCTS FROM THESE PLANTS WERE PHOSPHORIC ACID AND PELLETT-TYPE FERTILIZERS OF VARYING MIXTURES OF NITROGEN AND PHOSPHORUS. THE INDUSTRIAL COMPLEX CEASED OPERATION IN 1981 EXCEPT FOR LIMITED MINING AND MILLING OPERATIONS MENTIONED ABOVE.

CONTROL OF ATMOSPHERIC EMISSIONS, SOLID WASTE DISPOSAL, AND WASTEWATER TREATMENT AT THE BUNKER HILL COMPLEX EVOLVED WITH CHANGING TECHNOLOGIES AND REGULATIONS. INITIALLY, MOST LIQUID AND SOLID RESIDUE FROM THE COMPLEX WAS DISCHARGED INTO THE SOUTH FORK OF THE COEUR D'ALENE RIVER AND ITS TRIBUTARIES. THE RIVER PERIODICALLY FLOODED AND DEPOSITED WASTE MATERIAL LADEN WITH LEAD, ZINC, AND OTHER HEAVY METALS ONTO THE VALLEY FLOOR. OPERATION AND DISPOSAL PRACTICES CAUSED DEPOSITION OF HAZARDOUS SUBSTANCES THROUGHOUT THE VALLEY. LEACHING OF THESE DEPOSITS THROUGH THE SOIL HAS CONTRIBUTED TO HEAVY METAL CONTAMINATION OF THE RIVER AND GROUNDWATER.

A 1973 FIRE IN THE BAGHOUSE AT THE LEAD SMELTER MAIN STACK SEVERELY REDUCED AIR POLLUTION CONTROL CAPACITY. TOTAL PARTICULATE EMISSIONS OF ABOUT 15 TO 160 TONS PER MONTH, CONTAINING 50 TO 70 PERCENT LEAD, WERE REPORTED FROM THE TIME OF THE FIRE THROUGH NOVEMBER 1974. THIS COMPARES TO EMISSIONS OF ABOUT 10 TO 20 TONS PER MONTH PRIOR TO THE FIRE. THE IMMEDIATE EFFECTS OF INCREASED TOTAL LEAD EMISSIONS AND HIGH TOTAL LEAD IN AIR CONTENT WERE OBSERVED IN A 1974

PUBLIC HEALTH STUDY WHERE A SIGNIFICANT NUMBER OF CHILDREN HAD ELEVATED BLOOD LEAD LEVELS. LEAD SMELTER STACK EMISSIONS FOLLOWING THE 1973 BAGHOUSE FIRE ARE A SIGNIFICANT SOURCE OF CURRENT SITE CONTAMINATION.

IN 1977, TALL STACKS (GT 600 FEET) WERE ADDED AT BOTH THE ZINC AND LEAD SMELTERS TO MORE EFFECTIVELY DISPERSE CONTAMINANTS FROM THE COMPLEX. THESE DEVICES DECREASED SULFUR OXIDES CONCENTRATIONS IN THE LATE 1970S. THE SMELTER AND OTHER BUNKER HILL COMPANY ACTIVITIES CEASED OPERATION IN DECEMBER 1981, AND PORTIONS OF THE SMELTER COMPLEX HAVE SINCE BEEN SALVAGED FOR VARIOUS MATERIALS, MACHINERY, AND SCRAP.

ALTHOUGH IN RECENT YEARS SOME WASTES HAVE BEEN SHIPPED OFFSITE FOR DISPOSAL IN LANDFILLS, THOUSANDS OF TONS OF SLUDGE, TAILINGS, FLUE DUST, AND OTHER WASTES REMAIN AT THE COMPLEX. THESE MATERIALS CONTAIN HIGH LEVELS OF ARSENIC, LEAD, AND OTHER METALS.

2.2 INITIAL INVESTIGATIONS

CONTAMINATED AIR, SOILS, AND DUSTS HAVE BEEN IDENTIFIED AS CONTRIBUTORS TO ELEVATED BLOOD LEAD LEVELS IN CHILDREN LIVING IN THE POPULATED AREAS OF BUNKER HILL SITE. ENVIRONMENTAL MEDIA CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN THE POPULATED AREAS ARE STRONGLY DEPENDENT ON DISTANCE FROM THE SMELTER FACILITY AND INDUSTRIAL COMPLEX. RESIDENTIAL AREAS NEAREST THE SMELTER COMPLEX HAVE SHOWN THE GREATEST AIR, SOIL, AND DUST LEAD CONCENTRATIONS; THE HIGHEST CHILDHOOD BLOOD LEAD LEVELS; AND THE GREATEST INCIDENCE OF EXCESS ABSORPTION IN EACH OF THE STUDIES CONDUCTED IN THE LAST DECADE.

HEALTH EFFECTS OF ENVIRONMENTAL CONTAMINATION WERE FIRST DOCUMENTED FOLLOWING THE SMELTER BAGHOUSE FIRE AND ASSOCIATED SMELTER EMISSIONS IN 1973 AND 1974. UP TO 75 PERCENT OF THE PRESCHOOL CHILDREN TESTED WITHIN SEVERAL MILES OF THE COMPLEX HAD BLOOD LEAD LEVELS AT THAT TIME THAT EXCEEDED CENTERS FOR DISEASE CONTROL (CDC) CRITERIA. SEVERAL LOCAL CHILDREN WERE DIAGNOSED WITH CLINICAL LEAD POISONING AND REQUIRED HOSPITALIZATION. LEAD HEALTH SURVEYS CONDUCTED THROUGHOUT THE 1970'S CONFIRMED THAT EXCESS BLOOD LEAD ABSORPTION WAS ENDEMIC TO THIS COMMUNITY. CONCURRENT EPIDEMIOLOGIC AND ENVIRONMENTAL INVESTIGATIONS CONCLUDED THAT ATMOSPHERIC EMISSIONS OF PARTICULATE LEAD FROM THE ACTIVE SMELTER WERE THE PRIMARY SOURCES OF ENVIRONMENTAL LEAD THAT AFFECTED CHILDREN'S BLOOD LEAD LEVELS PRIOR TO 1981. CONTAMINATED SOILS WERE ALSO FOUND TO BE A SIGNIFICANT, HOWEVER SECONDARY, SOURCE OF LEAD TO CHILDREN IN THE 1970S.

FOLLOWING LEAD POISONING INCIDENTS IN 1973, A NUMBER OF ACTIVITIES WERE INSTITUTED TO DECREASE LEAD EXPOSURES AND UPTAKES IN THE COMMUNITY. IN A AUGUST 1974 SURVEY, 99 PERCENT OF THE 1-TO 9 YEAR-OLD CHILDREN LIVING WITHIN ONE MILE OF THE SMELTER WERE FOUND TO HAVE BLOOD LEAD LEVELS IN EXCESS OF 40 UG/DL. THE FREQUENCY OF ABNORMAL LEAD ABSORPTION (DEFINED AT THE TIME AS GREATER THAN OR EQUAL TO 40 UG/DL) WAS FOUND TO DECREASE WITH INCREASING DISTANCE FROM THE SMELTER. FOLLOWING THE ANNOUNCEMENT OF THESE RESULTS, EMERGENCY MEASURES WERE INITIATED TO REDUCE THE RISK OF LEAD INTOXICATION. THESE MEASURES INCLUDED: CHELATION OF CHILDREN WITH BLOOD LEAD OVER 80 UG/DL, PURCHASE AND DESTRUCTION OF AS MANY HOMES AS POSSIBLE WITHIN 0.5 MILE OF THE SMELTER, DISTRIBUTION OF "CLAN" SOIL AND GRAVEL TO COVER HIGHLY CONTAMINATED AREAS, INITIATION OF A HYGIENE PROGRAM IN THE SCHOOLS, AND REDUCTION OF AMBIENT AIR LEAD LEVELS THROUGH REDUCTION OF SMELTER EMISSIONS. STREET CLEANING AND WATERING IN DUST-PRODUCING AREAS OCCURRED DURING SEVERAL PERIODS IN THE LATE 1970S. SUBSIDIES WERE PROVIDED BY THE BUNKER HILL COMPANY TO RESIDENTS FOR THE PURCHASE OF CLEAN TOP SOIL, SAND, GRAVEL, GRASS SEED AND WATER, THEREBY PROMOTING SOME YARD COVER IN THE COMMUNITY.

AN ANALYSIS OF HISTORICAL EXPOSURES TO CHILDREN WHO WERE TWO YEARS OLD IN 1973 SUGGESTS A HIGH RISK TO NORMAL CHILDHOOD DEVELOPMENT AND METAL ACCUMULATION IN BONES BECAUSE OF EXTREME EXPOSURES; THESE EXPOSURES COULD OFFER A CONTINUING LEAD BODY BURDEN IN THESE CHILDREN BECAUSE OF ITS LONG PHYSIOLOGIC HALF LIFE. FEMALES WHO WERE TWO YEARS OF AGE DURING 1973 ARE NOW OF

CHILDBEARING AGE AND, EVEN WITH MAXIMUM REDUCTION IN CURRENT EXPOSURE TO LEAD, THE FETUS MAY BE AT RISK BECAUSE OF RESORPTION OF BONE LEAD STORES IN THE YOUNG WOMEN.

FOLLOWING SMELTER CLOSURE IN LATE 1981, AIRBORNE LEAD CONTAMINATION DECREASED BY A FACTOR OF 10, FROM APPROXIMATELY 5 UG/M3 TO 0.5 UG/M3. A 1983 SURVEY OF CHILDREN'S BLOOD LEAD LEVELS DEMONSTRATED A SIGNIFICANT DECREASE IN COMMUNITY EXPOSURES TO LEAD CONTAMINATION; HOWEVER, THE SURVEY ALSO FOUND THAT SEVERAL CHILDREN, INCLUDING SOME BORN SINCE 1981, CONTINUED TO EXHIBIT BLOOD LEAD LEVELS IN EXCESS OF RECOMMENDED PUBLIC HEALTH CRITERIA. ACCOMPANYING EPIDEMIOLOGICAL ANALYSES SUGGESTED THAT CONTAMINATED SOILS AND DUSTS REPRESENTED THE MOST ACCESSIBLE SOURCES OF ENVIRONMENTAL LEAD IN THE COMMUNITY.

CHILDHOOD MEAN BLOOD LEAD LEVELS HAVE CONTINUED TO DECREASE SINCE 1953. THESE DECREASES ARE LIKELY RELATED TO A NATIONWIDE REDUCTION IN DIETARY LEAD; REDUCED SOIL, DUST, AND AIR LEVELS IN THE COMMUNITY; INTAKE REDUCTIONS ACHIEVED THROUGH DENYING ACCESS TO SOURCES; AND THE INCREASE IN FAMILY AND PERSONAL HYGIENE PRACTICED IN THE COMMUNITY. THE LATTER IS REFLECTED IN THE IMPLEMENTATION OF A COMPREHENSIVE COMMUNITY HEALTH INTERVENTION PROGRAM IN 1954 THAT ENCOURAGES IMPROVED HYGIENIC (HOUSEKEEPING) PRACTICES, INCREASED VIGILANCE, PARENTAL AWARENESS, AND SPECIAL CONSULTATION ON INDIVIDUAL SOURCE CONTROL PRACTICES SUCH AS LAWN CARE, REMOVALS, AND RESTRICTIONS. THE COMMUNITY HEALTH INTERVENTION PROGRAM WAS INITIATED SPECIFICALLY TO REDUCE THE POTENTIAL FOR EXCESS ABSORPTIONS AND MINIMIZE TOTAL ABSORPTION IN THE POPULATION UNTIL INITIATION OF REMEDIAL ACTIVITIES. TOTAL BLOOD LEAD ABSORPTION AMONG THE COMMUNITY'S CHILDREN HAS BEEN REDUCED NEARLY 50 PERCENT SINCE 1953. THE INCIDENCE OF LEAD TOXICITY (BLOOD LEAD GT 25 UG/DL) HAS FALLEN FROM 25 PERCENT TO LESS THAN 5 PERCENT FOR CHILDREN IN THE HIGHEST EXPOSURE AREAS. RECENT BLOOD LEAD MONITORING HAS SHOWN 37 TO 56 PERCENT OF AREA CHILDREN SURVEYED EXCEED THE BLOOD LEAD LEVEL OF 10 UG/DL.

2.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

THE BUNKER HILL SITE WAS PLACED ON THE NATIONAL PRIORITIES LIST (NPL) IN SEPTEMBER 1983 (48 FR 40658). RI/FS ACTIVITIES WERE INITIATED IN LATE 1984 FOLLOWING COMPLETION OF THE 1983 LEAD HEALTH STUDY.

THE BUNKER HILL SITE CHARACTERIZATION REPORT (SCR) WAS THE FIRST STEP IN THE RI PROCESS. THE OBJECTIVE OF THE SCR WAS TO DESCRIBE AND ANALYZE EXISTING INFORMATION. THE EXISTING INFORMATION INCLUDED FILES FROM FEDERAL, STATE, AND LOCAL AGENCIES, AS WELL AS INFORMATION OBTAINED FROM PAST AND PRESENT OWNERS AND OPERATORS OF THE INDUSTRIAL COMPLEX. THE SCR WAS THEN USED TO IDENTIFY DATA GAPS AND DEVELOP WORK PLANS FOR THE REMEDIAL INVESTIGATION.

IN RECOGNITION OF THE HISTORY AND COMPLEXITY OF THIS SITE, AND THE CONTINUING NEED FOR ACTIVE HEALTH INTERVENTION EFFORTS, THE EPA AND IDHW DEVELOPED AN INTEGRATED PROJECT STRUCTURE FOR RI/FS ACTIVITIES. THE SITE WAS DIVIDED INTO TWO PRINCIPAL PORTIONS -- THE POPULATED AREAS AND THE NON-POPULATED AREAS. THE POPULATED AREAS INCLUDE SEVERAL CITIES, ALL RESIDENTIAL AND COMMERCIAL PROPERTIES LOCATED WITHIN THOSE CITIES, AND OTHER RESIDENTIAL PROPERTIES. THE NON-POPULATED AREAS INCLUDE THE SMELTER COMPLEX, RIVER FLOODPLAIN, BARREN HILLSIDES, GROUNDWATER, AIR POLLUTION, AND INDUSTRIAL WASTE COMPONENTS OF THE SITE.

WHILE SEPARATE RI/FS EFFORTS WERE INITIATED FOR EACH PORTION OF THE SITE, USEPA REGION 10 RETAINED OVERSIGHT AND RISK ASSESSMENT RESPONSIBILITIES FOR BOTH. IDHW CONDUCTED THE POPULATED AREAS RI/FS. THE NON-POPULATED AREAS RI/FS IS BEING CONDUCTED BY GULF RESOURCES & CHEMICAL CORPORATION UNDER A USEPA ADMINISTRATIVE ORDER ON CONSENT SIGNED BY USEPA IN MAY 1987. TABLE 2-1 LISTS THE MAJOR GEOGRAPHIC FEATURES AND INVESTIGATION EMPHASES.

2.4 HISTORY OF CERCLA ENFORCEMENT

SEVERAL COMPANIES HAVE BEEN IDENTIFIED BY USEPA AS POTENTIALLY RESPONSIBLE PARTIES (PRPS) FOR THE BUNKER HILL SUPERFUND SITE. TABLE 2-2 LISTS THE PRPS FOR BUNKER HILL AND THE DATES THEY WERE NOTIFIED. THE PRPS REPRESENT A COMBINATION OF PAST AND PRESENT PROPERTY OWNERS, OWNERS AND OPERATORS OF THE VARIOUS SMELTING, PROCESSING, AND PRODUCTION FACILITIES LOCATED WITHIN THE INDUSTRIAL COMPLEX, AND UPSTREAM MINING COMPANIES THAT WERE RESPONSIBLE FOR TAILINGS DISCHARGES INTO THE SOUTH FORK OF THE COEUR D'AIENE RIVER THAT HAVE CONTRIBUTED TO THE CONTAMINATION OF THE SITE.

IN 1989, USEPA RECOVERED \$1.4 MILLION FROM GULF RESOURCES AND CHEMICAL CORPORATION IN A SETTLEMENT REGARDING SUPERFUND MONEY SPENT DURING THE REMOVAL ACTION IN 1986. AGENCY OVERSIGHT COSTS ASSOCIATED WITH THE NON-POPULATED RI/FS HAVE BEEN RECEIVED FROM GULF RESOURCES AND CHEMICAL CORPORATION FOR 1987 THROUGH 1989. ON MAY 2, 1990, USEPA FILED A CIVIL ACTION OR PENALTIES AGAINST BUNKER LIMITED PARTNERSHIP FOR FAILURE TO RESPOND TO USEPA'S OCTOBER 1988 REQUEST FOR INFORMATION. THE CASE IS STILL PENDING IN US DISTRICT COURT IN BOISE, IDAHO.

2.5 REMOVAL ACTIONS

THERE HAVE BEEN TWO SUPERFUND-FINANCED REMOVAL ACTIONS (1986 AND 1989 RESIDENTIAL SOILS); ONE REMOVAL ACTION WAS FINANCED BY THE PRPS BUT PERFORMED BY THE AGENCIES (1990 RESIDENTIAL SOILS); AND THERE HAVE BEEN THREE PRP-PERFORMED REMOVAL ACTIONS (1989 SMELTER COMPLEX STABILIZATION, 1990 HILLSIDES REVEGETATION, AND 1991 RESIDENTIAL SOILS, ETC).

IN 1986, 16 PUBLIC PROPERTIES (PARKS, PLAYGROUNDS, AND ROAD SHOULDERS) WERE SELECTED FOR AN IMMEDIATE REMOVAL ACTION BECAUSE THESE PROPERTIES CONTAINED HIGH CONCENTRATIONS OF LEAD AND WERE FREQUENTED BY MANY AREA CHILDREN. THE ACTION CONSISTED OF PLACING A BARRIER BETWEEN CHILDREN AND THE UNDERLYING CONTAMINATED SOIL. SIX INCHES OF CONTAMINATED MATERIALS WERE EXCAVATED, AND CLEAN SOIL, SOD AND/OR GRAVEL WERE IMPORTED FOR REPLACEMENT. EXCAVATED MATERIAL WAS TEMPORARILY STORED WITHIN SITE BOUNDARIES AT PROPERTY OWNED BY THE IDAHO TRANSPORTATION DEPARTMENT (ITD).

IN 1989, THE USEPA AND IDHW BEGAN A RESIDENTIAL SOIL REMOVAL PROGRAM. THE PROGRAM PRIORITIZED YARDS THAT HAD A LEAD CONCENTRATION GREATER THAN OR EQUAL TO 1,000 PPM AND HOUSED EITHER A YOUNG CHILD OR A PREGNANT WOMAN. THIS ACTION CONSISTED OF REMOVING 6 TO 12 INCHES OF CONTAMINATED MATERIAL FROM YARDS AND REPLACING IT IN KIND WITH CLEAN MATERIAL. CONTAMINATED SOILS WERE AGAIN STORED AT THE ITD PROPERTY WITHIN SITE BOUNDARIES. IN 1989, YARD SOIL REPLACEMENT WAS COMPLETED AT 81 HOMES AND 2 APARTMENT COMPLEXES WITHIN THE POPULATED AREAS OF THE SITE.

AN ADMINISTRATIVE UNILATERAL ORDER WAS ISSUED OCTOBER 24, 1989 (USEPA DOCKET NUMBER 1089-10-21-106), TO BUNKER LIMITED PARTNERSHIP, MINERALS CORPORATION OF IDAHO, BUNKER HILL MINING COMPANY, (US) INC. AND GULF RESOURCES AND CHEMICAL CORPORATION. THE PURPOSE OF THE ORDER WAS TO IMPLEMENT ACTIONS TO STABILIZE SEVERAL PROBLEM AREAS WITHIN THE INDUSTRIAL COMPLEX. ACTIONS REQUIRED BY THE ORDER INCLUDED IMMEDIATE CESSATION OF SALVAGING ACTIVITIES ONSITE, ESTABLISHMENT OF SITE ACCESS RESTRICTIONS, DEVELOPMENT OF A DUST CONTROL PLAN, AND STABILIZATION AND CONTAINMENT OF THE COPPER DROSS FLUE DUST PILE.

AN ADMINISTRATIVE UNILATERAL ORDER WAS ISSUED TO ALL NAMED PRPS ON MAY 15, 1990 (USEPA DOCKET NO. 1090-05-25-106(A)), WHICH REQUIRED THE CONTINUATION OF THE RESIDENTIAL SOIL REMOVAL PROGRAM WITHIN THE BOUNDARIES OF THE SUPERFUND SITE. SETTLEMENT OF THIS ORDER RESULTED IN AN AGREEMENT BETWEEN USEPA AND EIGHT OF THE PRPS (GULF RESOURCES & CHEMICAL CORPORATION, HECLA MINING COMPANY, ASARCO, INC., STAUFFER CHEMICAL COMPANY, CALLAHAN MINING CORPORATION, COEUR D'ALENE MINES CORPORATION, SUNSHINE PRECIOUS METALS, INC., AND UNION PACIFIC RAILROAD) FOR PAYMENT OF \$3,180,000 TO USEPA (USEPA DOCKET NUMBER 1090-05-35-106) FOR PERFORMANCE OF THE 1990 RESIDENTIAL SOIL REMOVAL ACTION. YARD SOIL REMOVAL AND REPLACEMENT FOR AN ADDITIONAL 130 YARDS WERE

PERFORMED IN 1990. EXCAVATED SOILS FROM THIS REMOVAL ACTION WERE STORED AT THE PAGE PONDS TAILINGS IMPOUNDMENT.

AN ADMINISTRATIVE ORDER ON CONSENT TO IMPLEMENT HILLSIDE STABILIZATION AND REVEGETATION WORK WAS ENTERED INTO BETWEEN USEPA AND GULF RESOURCES & CHEMICAL CORPORATION, AND HECLA MINING COMPANY, ON OCTOBER 1, 1990 (USEPA DOCKET NO. 1090-10-01-106). THE OBJECTIVES OF THIS ORDER ARE TO CONTROL EROSION BY REESTABLISHING A NATIVE, CLOSED, CONIFEROUS FOREST AND UNDERSTORY VEGETATIVE COVER TO APPROXIMATELY 3,200 ACRES OF BARREN HILLSIDES AND TO PERFORM TERRACE REPAIR AND CONSTRUCTION OF DETENTION BASINS, AND REPAIR OF THE ROCKSLIDE AREAS IN WARDNER AND SMELTERVILLE. PLANTING OF TREES IS SCHEDULED TO BE COMPLETED IN 1996.

IN JULY OF 1991, AN ADMINISTRATIVE ORDER ON CONSENT (USEPA DOCKET NO. 1091-06-17-106(A)) WAS ENTERED INTO BETWEEN USEPA AND NINE PRPS (GULF RESOURCES AND CHEMICAL CORPORATION, HECLA MINING COMPANY, ASARCO, INC., STAUFFER CHEMICAL COMPANY, CALLAHAN MINING CORPORATION, COEUR D'AIENE MINES CORPORATION, SUNSHINE PRECIOUS METALS, INC, UNION PACIFIC RAILROAD, AND SUNSHINE MINING COMPANY) THAT REQUIRED THE PRPS TO PERFORM THE RESIDENTIAL SOIL REMOVAL PROGRAM. IT IS EXPECTED THAT APPROXIMATELY 80 MORE PROPERTIES WILL BE CLEANED UP THIS YEAR. AS IN 1990, EXCAVATED SOILS WERE STORED AT THE PAGE PONDS TAILINGS IMPOUNDMENT. UNDER THIS ORDER, THE PARTIES HAVE ALSO AGREED TO UNDERTAKE SITEWIDE DUST CONTROL ACTIONS; MONITOR AIR, GROUNDWATER AND SURFACE WATER; ENHANCE THE FIRE FIGHTING CAPABILITY AT THE INDUSTRIAL COMPLEX AND PROVIDE FUNDING TO PURCHASE HIGH-EFFICIENCY VACUUMS FOR LOAN AS PART OF THE HEALTH INTERVENTION PROGRAM.

#HCP

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

THERE HAS BEEN A LONG HISTORY OF COMMUNITY RELATIONS ACTIVITIES IN THE SILVER VALLEY. SINCE DISCOVERY OF ELEVATED BLOOD LEADS IN CHILDREN IN 1974, THE LDHW, PANHANDLE HEALTH DISTRICT (PHD), AND THE CDC HAVE CONTINUALLY WORKED WITH AREA RESIDENTS TO REDUCE EXPOSURES TO LEAD. IN 1985 THE SHOSHONE COUNTY COMMISSIONERS SELECTED A NINE-MEMBER TASK FORCE TO SERVE AS A LIAISON BETWEEN THE BUNKER HILL SUPERFUND PROJECT TEAM (COMPRISED OF REPRESENTATIVES OF USEPA AND IDHW AD CONTRACTORS) AND THE COMMUNITY. THE PHD WAS CONTRACTED BY IDHW TO PERFORM COMMUNITY RELATIONS TASKS FOR THE BUNKER HILL SUPERFUND SITE. A FULL-TIME LDHW STAFF PERSON HA ALSO BEEN STATIONED ONSITE FROM MID-1987 TO PRESENT.

PART OF THEIR DUTIES IS TO ASSIST IN COMMUNITY RELATION ACTIVITIES WHEN NEEDED.

THE FOCUS OF COMMUNITY CONTACT HAS BEEN THE NINE-MEMBER SILVER VALLEY TASK FORCE. THERE HAVE BEEN 35 PUBLIC TASK FORCE MEETINGS SINCE MAY OF 1985. THESE MEETINGS CONSISTED OF PRESENTATIONS BY THE BUNKER HILL PROJECT TEAM WITH TIME FOR QUESTIONS AD STATEMENTS FROM BOTH THE TASK FORCE AD THE GENERAL COMMUNITY. TWENTY-THREE FACT SHEETS HAVE BEEN PRODUCED SINCE MAY 1985 TO DISCS VARIOUS ASPECTS OF THE RL/FS ACTIVITIES AT THE SITE. SITE RECORDS HAVE ALSO BEEN MADE AVAILABLE TO THE PUBLIC THROUGH FOUR PUBLIC INFORMATION REPOSITORIES. THE COMMUNITY WAS INVOLVED IN THE SELECTION OF ACTIVITIES ASSOCIATED WITH THE RESIDENTIAL SOIL REMOVAL ACTIONS THROUGH A PUBLIC COMMENT PERIOD. THIS EXPERIENCE, ALONG WITH THE OPPORTUNITY TO OBSERVE THE CLEANUP ACTIVITY OVER THE LAST 2 YEARS, HAS HELPED FAMILIARIZE THE COMMUNITY WITH THE REMEDIATION OF RESIDENTIAL SOILS.

A SERIES OF MEETINGS HAS BEEN HELD BETWEEN THE PHD AND LOCAL PLANNING AND ZONING COMMISSIONS, CITY COUNCILS, AND COUNTY COMMISSIONERS TO HELP DEVELOP THE "EVALUATION OF INSTITUTIONAL CONTROLS FOR THE BUNKER HILL SUPERFUND SITE." INSTITUTIONAL CONTROL DEVELOPMENT PRESENTATIONS WERE ALSO MADE TO LOCAL BUSINESS AND COMMUNITY GROUPS.

THE "RISK ASSESSMENT DATA EVALUATION REPORT, " THE RESIDENTIAL SOILS FOCUSED FEASIBILITY STUDY," THE "PROPOSED PLAN FOR CLEANUP OF RESIDENTIAL SOIL WITHIN THE POPULATED AREAS OF THE BUNKER HILL

SUPERFUND SITE," AND "AN EVALUATION OF INSTITUTIONAL CONTROLS FOR THE BUNKER HILL SUPERFUND SITE" WERE RELEASED FOR PUBLIC REVIEW APRIL 29, 1991. THESE FOUR DOCUMENTS WERE MADE AVAILABLE IN THE ADMINISTRATIVE RECORD FILE, WHICH IS LOCATED AT THE KELLOGG CITY HALL, AND THE FOUR INFORMATION REPOSITORIES, WHICH ARE LOCATED AT THE KELLOGG CITY HALL, KELLOGG PUBLIC LIBRARY, SMELTERVILLE CITY HALL, AND PINEHURST/KINGSTON LIBRARY. THE NOTICE OF AVAILABILITY OF THE DOCUMENTS WAS PUBLISHED IN THE "SHOSHONE NEWS PRESS" FROM APRIL 26 THROUGH APRIL 30, 1991. THE NOTICE OUTLINED THE REMEDIAL ALTERNATIVES EVALUATED AND IDENTIFIED THE PROPOSED ALTERNATIVE. A PUBLIC COMMENT PERIOD WAS ESTABLISHED FOR APRIL 29 TO MAY 31 AND WAS EXTENDED TO JUNE 30, 1991, AFTER A REQUEST TO EXTEND THE PERIOD WAS RECEIVED. PENSION OF THE PUBLIC COMMENT PERIOD WAS PUBLISHED IN THE "SHOSHONE NEWS PRESS" MAY 24 THROUGH 26, 1991. A PUBLIC HEARING WAS HELD MAY 23, 1991, TO ANSWER QUESTIONS AND TAKE COMMENTS. THERE WERE APPROXIMATELY 100 ATTENDEES AT THE MEETING. A TRANSCRIPT OF QUESTIONS ASKED AND ANSWERS GIVEN AT THE PUBLIC HEARING IS INCLUDED IN THE ADMINISTRATIVE RECORD. RESPONSES TO WRITTEN COMMENTS ARE INCLUDED IN THE RESPONSIVENESS SUMMARY, WHICH IS PART OF THIS RECORD OF DECISION.

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4.0 SCOPE AND ROLE OF OPERABLE UNIT

THE RATIONALE FOR SEPARATING THE BUNKER HILL RI/FS INTO TWO PARTS INVOLVED BOTH DATA AVAILABILITY AND CONFIDENTIALITY ISSUES DATED WITH A INVESTIGATION OF PRIVATE RESIDENTIAL PROPERTIES WITHIN THE POPULATED AREAS. WITH BOTH ENVIRONMENTAL DATA AND AN ABUNDANCE OF HUMAN HEALTH RELATED DATA, COLLECTED AS PART OF THE EPIDEMIOLOGICAL STUDIES, THE AGENCIES BELIEVED THAT THE POPULATED AREAS RI/FS COULD BEST BE COMPLETED BY GOVERNMENT AGENCIES IN ORDER TO HONOR CONFIDENTIALITY AGREEMENTS WITH INDIVIDUALS AND INDIVIDUAL PROPERTY OWNERS.

THE RISK ASSESSMENT DATA EVALUATION REPORT (RADER) FOR THE POPULATED AREAS OF THE SITE -- HAS BEEN COMPLETED. THE RESIDENTIAL SOILS FEASIBILITY STUDY IS ALSO COMPLETE AND IS THE FIRST UNIT TO BE ADDRESSED IN A RECORD OF DECISION. THE OTHER UNITS THAT ARE RELATED TO THE POPULATED AREAS INVESTIGATION THAT HAVE NOT BEEN ADDRESSED IN A DECISION DOCUMENT INCLUDE: HOUSE DUST, COMMERCIAL PROPERTIES, AND ROAD SHOULDERS AND RIGHTS-OF-WAY. THE AGENCIES ORIGINALLY EXPECTED TO ADDRESS THESE ISSUES IN A SECOND ROD IN 1992; HOWEVER, THE PRPS HAVE APPROACHED USEPA AND IDHW WITH A PROPOSAL FOR A SITEWIDE CLEANUP THAT INVOLVES ALL FACETS OF BOTH THE POPULATED AND NON-POPULATED AREAS. THE EFFORT TO COMPLETE THE RESIDENTIAL SOILS ROD WAS MAINTAINED, BECAUSE SOILS ARE A PRIMARY RISK TO THE RESIDENTS; HOWEVER, CONSOLIDATION OF ALL (SEE TABLE 2.1) REMAINING ISSUES INTO WHAT IS REFERRED TO AS THE EXPEDITED FS IS ONGOING. THE EXPEDITED FS IS EXPECTED TO SUPPORT A SECOND ROD FOR THE SITE THAT WILL ADDRESS ALL CONTAMINATED AREAS AND MEDIA NOT COVERED IN THIS ROD.

THE RADER CONCLUDED THAT SUBCHRONIC LEAD ABSORPTION AMONG YOUNG CHILDREN IS THE MOST SIGNIFICANT HEALTH RISK POSED BY THIS SITE. THE GREATEST RISKS TO YOUNG CHILDREN ARE ASSOCIATED WITH INGESTION OF RESIDENTIAL YARD SOILS, HOUSE DUSTS, AND LOCALLY GROWN PRODUCE. EXPOSURE TO RESIDENTIAL SOILS IS A PRIMARY HEALTH RISK TO AREA RESIDENTS, ALTHOUGH RESIDENTIAL SOILS ARE NOT A "PRINCIPAL THREAT" AS DEFINED BY USEPA. THE REMEDIAL ACTION DESCRIBED IN THIS ROD IS INTENDED TO MINIMIZE DIRECT CONTACT WITH AND INGESTION OF LEAD-CONTAMINATED RESIDENTIAL SOILS BY EXCAVATION AND REPLACEMENT OF THOSE SOILS WITH CLEAN MATERIAL. WHILE YARD SOILS REPRESENT A PRIMARY RISK TO LOCAL RESIDENTS, IT IS IMPORTANT TO RECOGNIZE THAT YARD SOILS REPRESENT ONLY ONE COMPONENT OF EXPOSURE IN THESE COMMUNITIES. OTHER SOURCES OF CONTAMINATION WITHIN THE SITE MUST BE ADDRESSED TO PREVENT ADDITIONAL POPULATION EXPOSURES AND RECONTAMINATION OF RESIDENTIAL SOIL BECAUSE OF CONTAMINANT MIGRATION. NO DIRECT ACTION IS BEING TAKEN FOR HOUSE DUST LEAD REDUCTION AT THIS TIME; HOWEVER, IT IS EXPECTED THAT HOUSE DUST LEAD CONCENTRATIONS WILL DECREASE AS YARD SOIL LEAD CONCENTRATIONS DECREASE AND FUGITIVE DUST SOURCES ARE CONTROLLED. PART OF THE ONGOING HEALTH INTERVENTION PROGRAM WILL BE TO LEND HIGH-EFFICIENCY HOME VACUUM CLEANERS TO INTERESTED RESIDENTS. FUGITIVE DUST CONTROL EFFORTS UNDERTAKEN AS PART OF THE 1991 REMOVAL ACTION WILL FURTHER REDUCE EXPOSURES AND THE TRANSPORT OF CONTAMINATED MATERIALS.

USE OF A THRESHOLD LEVEL OF 1,000 PPM LEAD (I.E., REMEDIAL ACTION AT ANY YARD WITH A LEAD CONCENTRATION OF 1,000 PPM OR ABOVE) WILL RESULT IN RESIDENTIAL COMMUNITY MEAN SOIL LEAD CONCENTRATIONS OF APPROXIMATELY 200 TO 300 PPM. CURRENT COMMUNITY MEAN SOIL LEAD CONCENTRATIONS ARE APPROXIMATELY 3,000 PPM. THE GOAL IS TO REDUCE SOIL LEAD CONCENTRATIONS SUCH THAT MEAN BLOOD LEAD LEVELS ARE BELOW 10 UG/DL AND THE RISK FOR ANY INDIVIDUAL CHILD TO HAVE A BLOOD LEAD LEVEL THAT EXCEEDS 10 UG/DL IS MINIMIZE.

LOCALLY GROWN PRODUCE IS A POTENTIALLY SIGNIFICANT EXPOSURE ROUTE FOR CADMIUM AND LEAD TO PREGNANT WOMEN AS WELL AS YOUNG CHILDREN. THIS ACTION WILL PROVIDE FOR SAFE PRODUCE GARDENING AREAS TO ENSURE THAT THIS EXPOSURE PATHWAY IS MINIMIZED. CURRENTLY, THE HEALTH INTERVENTION PROGRAM RECOMMENDS THAT PRODUCE GROWN IN LOCAL GARDENS NOT BE CONSUMED.

THERE ARE APPROXIMATELY 2,700 RESIDENTIAL PROPERTIES ONSITE. OF THOSE, APPROXIMATELY 50 PERCENT HAVE BEEN SAMPLED OF THE YARDS SAMPLED, 65 PERCENT HAVE SURFACE SOIL CONCENTRATIONS OF LEAD GREATER THAN OR EQUAL TO 1,000 PPM. IF THE UNSAMPLED YARDS SHOW A SIMILAR DISTRIBUTION, THIS ACTION IS EXPECTED TO INVOLVE REMEDIATION OF 65 PERCENT (APPROXIMATELY 1,800) OF THE RESIDENTIAL YARDS WITHIN THE SITE.

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5.0 SITE CHARACTERISTICS

5.1 PHYSICAL SETTING

TOPOGRAPHY OF THE SILVER VALLEY CONSISTS OF AN ALLUVIAL FLOODPLAIN BORDERED ON THE NORTH AND SOUTH BY STEEP MOUNTAINS. THE FLOODPLAIN RANGES IN WIDTH FROM ABOUT 0.1 MILE EAST OF KELLOGG TO APPROXIMATELY 0.9 MILE NEAR SMELTERVILLE. THE ELEVATION OF THE VALLEY FLOOR RANGES FROM 2,160 FEET ABOVE MEAN SEA LEVEL AT THE WEST END TO 2,320 FEET AT THE EAST END OF THE PROJECT SITE. THE VALLEY FLOOR IS NEARLY LEVEL, WITH SLOPES TYPICALLY LESS THAN 1 PERCENT. THE MOUNTAINS RISING FROM THE VALLEY RANGE FROM 500 TO 2,500 FEET ABOVE THE VALLEY FLOOR. THE MOUNTAINSIDES TYPICALLY EXHIBIT SLOPES OF 45 TO 90 PERCENT AND AT SOME POINTS EXCEED 110 PERCENT NUMEROUS VALLEYS AND GULCHES CUT THROUGH THE MOUNTAINS AND GENERALLY TREND NORTH TO SOUTH, INTERCEPTING THE VALLEY OF THE SOUTH FORK COEUR D'ALENE RIVER.

MOST RESIDENCES ARE LOCATED ON THE VALLEY FLOOR OR AT THE TOE OF THE HILLSIDE SLOPES. VALLEY FLOOR SOILS WERE FORMED FROM ALLUVIALLY DEPOSITED MATERIALS AND HAVE BEEN STRONGLY INFLUENCED BY MINE TAILINGS PLACED IN THE RIVER AS A RESULT OF PAST MINING ACTIVITY. IN GENERAL, THE ALLUVIAL VALLEY-FILL DEPOSITS ARE COMPRISED OF SILTY TO CLAYEY SAND AND GRAVEL. SOIL PARENT MATERIALS AT THE TOE OF THE STEEP SLOPES ARE COLLUVIAL AND MIXED COLLUVIAL/ALLUVIAL AND ARE HIGHLY EROSION. RESIDENTIAL SOILS HAVE BEEN MODIFIED BY TYPICAL EXCAVATION AND BACKFILL PRACTICES USED DURING HOME CONSTRUCTION.

VEGETATION IN THE RESIDENTIAL AREAS INCLUDES CONIFER AND DECIDUOUS TREES, GRASS LAWNS VARYING IN QUALITY WITH LEVEL OF MAINTENANCE, SOME VEGETABLE AND FLOWER GARDENS, AND NATIVE GRASSES IN UNDEVELOPED OR STEEPLY SLOPING AREAS.

THE METEOROLOGY OF THE SITE IS DOMINATED BY MOUNTAIN/TALLEY DRAINAGE WINDS RELATED TO THE LOCAL TOPOGRAPHY. THE ORIENTATION OF THE VALLEY EFFECTIVELY CHANNELS WINDS IN AN EAST-WEST DIRECTION. NOCTURNAL WINDS AVERAGE 4.5 MPH AND TEND TO BE FROM THE EAST. LATE MORNING AND AFTERNOON WINDS ARE FROM THE WEST AND SOUTHWEST, AVERAGING APPROXIMATELY 8 MPH. THE MEAN PRECIPITATION OF THE AREA RANGES FROM 30.4 INCHES AT KELLOGG TO 40.5 INCHES AT THE NEARBY CITY OF WALLACE, 10 MILES EAST (UPSTREAM) OF THE SITE. DATA FROM THE NATIONAL WEATHER SERVICE COLLECTED FROM 1951 TO 1980 SHOW AN ANNUAL MEAN TEMPERATURE IN KELLOGG OF 47.2 DEGREE FAHRENHEIT. A RECORD HIGH OF 111 DEGREE FAHRENHEIT WAS REACHED ON AUGUST 5, 1961, AND A RECORD LOW OF -36 DEGREE FAHRENHEIT ON DECEMBER 30, 1968. ON THE AVERAGE, 28 DAYS PER YEAR REACH A HIGH TEMPERATURE OF 90 DEGREE

FAHRENHEIT OR GREATER, AND 143 DAYS REACH A LOW OF 32 DEGREE FAHRENHEIT OR LESS.

5.2 NATURE AND EXTENT OF CONTAMINATION

THE SCOPE OF THE POPULATED AREAS RI INCLUDED RESIDENTIAL SOIL, FUGITIVE DUST SOURCE, HOUSE DUST, AND AIR MONITORING STUDIES. CONTAMINANTS OF CONCERN FOR RESIDENTIAL SOILS ARE ANTIMONY, ARSENIC, CADMIUM, COPPER, LEAD, MERCURY, AND ZINC. LEAD HAS BEEN IDENTIFIED AS THE PRIMARY CONTAMINANT OF CONCERN BASED ON HEALTH STUDIES.

RESIDENTIAL YARD SOIL CONCENTRATIONS ARE PRESENTED IN TABLE 5-1. THE RIGHT-HAND COLUMN OF THE TABLE PRESENTS BACKGROUND MEAN CONCENTRATIONS FOR COMPARISON. DATA FROM THE RESIDENTIAL YARDS SHOW THAT METAL CONCENTRATIONS IN SURFICIAL SOILS ARE GREATLY INCREASED OVER BACKGROUND RESIDENTIAL SOIL CONTAMINANT CONCENTRATIONS DECREASE WITH INCREASING DISTANCE FROM THE MILL AND SMELTER COMPLEX AND RESULT FROM A VARIETY OF HISTORICAL INDUSTRIAL ACTIVITIES.

METAL CONTAMINATION TO DEPTHS AS GREAT AS 3 FEET HAVE BEEN IDENTIFIED IN RESIDENTIAL SOILS. CONTAMINATION SOURCES AT THIS DEPTH ARE PRIMARILY ALLUVIALLY DEPOSITED TAILINGS.

TABLE 5-2 SUMMARIZES THE PERCENTAGE AND NUMBER OF PROPERTIES WITHIN EACH COMMUNITY WITH YARD SOIL LEAD CONCENTRATIONS ABOVE 1,000 PPM.

SOIL SAMPLES COLLECTED FROM 40 DIFFERENT YARDS WERE ANALYZED FOR OTHER POTENTIAL CONTAMINANTS SUCH AS EXTRACTABLE ORGANIC COMPOUNDS, CHLORINATED PESTICIDES, PCBS, AND MERCURY. MOST ORGANIC ANALYTES WERE NOT DETECTED. HOWEVER, OCCASIONAL DETECTIONS WERE NOTED FOR PHTHALATE ESTERS (PLASTICIZER COMPOUNDS), SOME POLYNUCLEAR AROMATIC HYDROCARBONS (I.E., NAPHTHALENE, PHENANTHRENE, FLUORANTHENE, PYRENE, BENZO(B) FLUORANTHENE, AND BENZO(A)PYRENE AS CONSTITUENTS OF FOSSIL FUELS AND THEIR COMBUSTION PRODUCTS), AND POLYCHLORINATED BIPHENYLS (PCBS AS COMPONENTS OF ELECTRICAL TRANSFORMER DIELECTRIC FLUIDS). CHLORINATED PESTICIDES WERE DETECTED IN SEVERAL SAMPLES IN EACH TOWN. FOR THOSE PESTICIDES OBSERVED, THE FREQUENCIES OF DETECTION RANGE FROM A LOW OF 14 PERCENT FOR ALDRIN, LINDANE, AND HEPTACHLOR TO A HIGH OF 100 PERCENT FOR DDT ISOMERS AND METABOLITES, CHLORDANE, AND HEPTACHLOR EPOXIDE. GREATEST CONCENTRATIONS AND FREQUENCIES OF DETECTION FOR PESTICIDES IN SOILS WERE FOUND IN SMELTERVILLE, KELLOGG, AND WARDNER, WITH SIGNIFICANTLY LOWER LEVELS IN PAGE. PRESENCE OF ORGANIC AND PESTICIDE CONTAMINANTS IN RESIDENTIAL SOIL COULD NOT BE RELATED TO MINING AND INDUSTRIAL ACTIVITIES ASSOCIATED WITH THE SITE.

MANY RESIDENTIAL STREETS AND ROADS DO NOT HAVE PAVED CURBS AND SIDEWALKS METALS CONCENTRATIONS FROM SAMPLES COLLECTED FROM THE SURFACE INCH OF THE ROAD SHOULDERS ARE SHOWN IN TABLE 5-3. METALS CONCENTRATIONS IN ROADSIDE SAMPLES SHOW CONSIDERABLE VARIATION, BOTH GEOGRAPHICALLY AND WITHIN TOWNS. SAMPLES FROM SMELTERVILLE RANGED FROM 249 TO 60,100 PPM PB; 3 TO 487 PPM CD; AND 19 TO 810 PPM AS. SAMPLES FROM THE SUNNYSIDE AREA OF KELLOGG (NORTH OF I-90) AVERAGED 1,935 PPM PB; 19 PPM CD; AND 71 PPM AS. OLD TOWN AREA (SOUTH OF I-90) SAMPLES AVERAGED 4,497 PPM PB; 28.6 PPM CD; AND 81 PPM AS. WARDNER AND PINEHURST AREA SAMPLES WERE NOTABLY LOWER, AVERAGING 1,385 PPM PB; 15 PPM CD; AND 73 PPM AS. SAMPLES OF STREET SWEEPER DUST SHOWED LEAD CONTENTS FROM 1,560 TO 2,230 PPM AND ZINC LEVELS EXCEEDING 10,000 PPM (1 PERCENT).

IN 1988 AND 1989, EFFORTS WERE UNDERTAKEN TO ASSESS RECONTAMINATION AT SITES CLEANED UP IN THE SUMMER OF 1986. REMOVAL ACTIONS IMPLEMENTED DURING 1986 INCLUDED A 6-INCH REMOVAL OF CONTAMINATED SOILS AND REPLACEMENT WITH CLEAN MATERIALS AND SOD IN PARKS AND PLAYGROUNDS, AND ASPHALTING OR GRAVEL COVER OF ROADSIDES AND PARKING LOTS. TABLE 5-4 SUMMARIZES THE ORIGINAL (PREREMEDIATION) LEAD CONCENTRATIONS, REMEDIAL MATERIAL (CLEAN FILL) LEAD CONCENTRATIONS, AND THE TWO RECONTAMINATION ASSESSMENT EFFORTS.

THE FEW SOD SAMPLES COLLECTED SUGGEST SURFACE RECONTAMINATION RATES OF 10 TO 100 PPM/YR LEAD.

NO RECONTAMINATION WAS EVIDENT IN EITHER THE TOP INCH OR MIDDLE OF THE SOIL FILL ON SODDED SITES OR PLAY FIELD. SOME RECONTAMINATION WAS EVIDENT AT THE INTERFACE OF REPLACED SOILS AND TOP OF THE ORIGINAL CUT. WHETHER THIS WAS DUE TO CONTAMINANT MIGRATION, MIXING AT THE TIME OF PLACEMENT, OR IMPRECISE LAYERING OF THE SAMPLE IS UNKNOWN. RUDIMENTARY MODELING HAS INDICATED THAT UPWARD MIGRATION POTENTIAL EXISTS ONLY IN ISOLATED AREAS WHERE THERE IS SHALLOW GROUNDWATER.

GRAVELED AREAS, PARTICULARLY THOSE USED AS PARKING LOTS, SHOWED SIGNIFICANT RECONTAMINATION. BECAUSE OF THE LOW RATES OF SURFACE DEPOSITION, THESE INCREASES LIKELY RESULTED FROM THE CONTINUAL WORKING OF THE ORIGINAL SOIL LAYERS BELOW THE REPLACEMENT MATERIALS OR TRACKING OF CONTAMINANTS ONTO THE SITE BY VEHICLES.

MIGRATION AND TRANSPORT OF CONTAMINATED SOLIDS FROM THE INDUSTRIAL COMPLEX AND OTHER FUGITIVE DUST SOURCES ARE A MAJOR CONCERN IN BOTH THE POPULATED AND NON-POPULATED AREAS OF THE SITE. WINDBLOWN DUSTS ARE POTENTIALLY SIGNIFICANT CONTRIBUTORS TO CONTAMINANT CONCENTRATIONS IN HUMAN RECEPTOR MEDIA IN THE POPULATED AREAS AND HAVE BEEN IDENTIFIED AS A MAJOR SOURCE OF PUBLIC COMPLAINT. MANY OF THE IDENTIFIED FUGITIVE DUST SOURCES ARE BARREN SOILS AND IMPOUNDED WASTES AND STORAGE PILES THAT CAN RESULT IN SIGNIFICANT AMOUNTS OF REENTRAINED DUSTS.

EIGHTEEN MAJOR BARREN AREAS IDENTIFIED AS HAVING A POTENTIALLY SIGNIFICANT IMPACT ON THE RESIDENTIAL AREAS WERE SAMPLED DURING REMEDIAL INVESTIGATIONS IN 1986. TABLE 5-5 IDENTIFIES THE AREAS SAMPLED, THE RESPECTIVE SIZE OF EACH AREA, THE NUMBER OF SAMPLES COLLECTED, SUMMARY STATISTICS FOR LEAD CONTENT IN THE MINUS 200-MESH PORTION OF THE SAMPLE, AND THE AVERAGE PERCENTAGE (BY WEIGHT) THAT PASSED THE 200-MESH SIEVE. ANTIMONY, ARSENIC, CADMIUM, COPPER, AND ZINC WERE ALSO DETECTED IN ALL SAMPLES COLLECTED. LOCATIONS OF THE FUGITIVE DUST SOURCE AREAS SAMPLED ARE PROVIDED IN FIGURE 5-1.

HIGHEST METAL CONCENTRATIONS AMONG FUGITIVE DUST SOURCES WERE FOUND ADJACENT TO THE CONCENTRATOR BUILDING, WITH THE LEAD CONCENTRATION AVERAGING ABOUT 230,000 PPM (23 PERCENT), AND ARSENIC AND CADMIUM LEVELS EACH AT APPROXIMATELY 10,000 PPM (1 PERCENT). DUST CONTENT FOR THIS SAMPLE WAS HIGH WITH 30 PERCENT OF THE SOLIDS PASSING A 200-MESH SIEVE. THE SURROUNDING AREAS (11 AND 12) ALSO HAVE RELATIVELY HIGH METAL CONTAMINANT LEVELS THAT MAY BE RELATED TO EMISSIONS FROM THE CONCENTRATOR AR& BARREN AREAS NEAR SHOSHONE APARTMENTS (AREA 11) AND THE WATER TREATMENT FLAT (AREA 12) EXHIBIT APPROXIMATELY 49,000 PPM (4.9 PERCENT) AND 43,000 PPM (4.3 PERCENT) LEAD IN SURFACE DUST, RESPECTIVELY. THE ARITHMETIC MEAN LEAD CONCENTRATION FOR ALL FUGITIVE DUST SOURCE AREAS IS 28,400 PPM (2.8 PERCENT). SOURCE AREAS NEAR THE SMELTER COMPLEX AND THROUGHOUT THE RIVER FLOODPLAIN ROUTINELY EXHIBITED LEVELS IN EXCESS OF 2 PERCENT LEAD. PERCENT OF SAMPLE SOLIDS TO PASS THE 200-MESH SIEVE RANGED FROM 6 TO 68 PERCENT, AVERAGING 30 PERCENT FOR ALL SAMPLES.

AIR MONITORING WAS USED TO INVESTIGATE AIR CONTAMINANT TRANSPORT MECHANISM. AIR MONITOR LOCATIONS ARE SHOWN IN FIGURE 5-2. TOTAL SUSPENDED PARTICULATE (TSP) DATA ARE SUMMARIZED IN TABLE 5-6. METAL CONTENT OF FILTERS COLLECTED ON HIGH DUST EVENT DAYS (DEFINED AS DAYS WITH TSP GT150 UG/M3) IS SUMMARIZED IN TABLE 5-7. THE 19 DAYS IN 1987 WHERE BLOWING DUST EVENTS WERE MEASURED ACCOUNT FOR 43 PERCENT OF THE TOTAL SUSPENDED PARTICULATES (TSP) LOADING FOR THE ENTIRE 116-DAY SAMPLING SEASON. THE SINGLE HIGHEST DAY (SEPTEMBER 2, 1987) ALONE ACCOUNTED FOR NEARLY 10 PERCENT OF THE TOTAL MONITORING SEASON LOADING. IN 1989, THE PEAK 10 DAYS ACCOUNTED FOR 48 PERCENT OF THE LOADING FOR THE 90-DAY MONITORING PERIOD.

METAL CONTAMINANT LEVELS IN HOUSE DUSTS ARE PRESENTED TABLE 5-8. HOUSE DUST METAL CONTAMINATION, AND ESPECIALLY LEAD CONTAMINATION, HAS DECREASED MARKEDLY SINCE 1974. FOR EXAMPLE, THE MEAN HOUSE DUST LEAD CONCENTRATION IN SMELTERVILLE FOR 1974 WAS APPROXIMATELY 12,000 PPM (1.2 PERCENT) AND HAS DECREASED TO A MEAN LEVEL IN 1988 THAT IS ONE-TENTH THE 1974 VALUE (1,200 PPM). PRIOR TO 1981, DURING SMELTER OPERATIONS, THE PRIMARY ROUTE FOR HOUSE DUST

LEAD CONTAMINATION WAS AIRBORNE DEPOSITION OF SMELTER LEAD PARTICULATE MATTER. SINCE 1981, HOUSE DUST METALS LEVELS HAVE BEEN RELATED TO RESIDENTIAL SOIL CONCENTRATION CONTAMINATED DUSTS REACH HOMES VIA DEPOSITION OF WINDBLOWN DUSTS OR MECHANICAL TRANSLOCATION OF CONTAMINATED RESIDENTIAL SOILS. SEVERAL STUDIES INDICATE HOUSE DUST LEAD LEVELS IN URBAN AND SMELTER COMMUNITIES (EXCLUSIVE OF THOSE IMPACTED BY INTERIOR LEADED PAINTS) ARE DEPENDENT ON LEAD LEVELS IN RESIDENTIAL SOILS.

5.3 CONTAMINANT MIGRATION

SOILS WITHIN THE SITE HAVE BEEN CONTAMINATED BY HEAVY METALS, TO VARYING DEGREES, THROUGH A COMBINATION OF AIRBORNE PARTICULATE DEPOSITION, ALLUVIAL DEPOSITION OF TAILINGS DUMPED INTO THE RIVER BY MINING ACTIVITIES, AND CONTAMINANT MIGRATION FROM ONSITE SOURCES. ONSITE SOURCES INCLUDE THE SMELTER FACILITY, INDUSTRIAL COMPLEX, TAILINGS AND OTHER WASTE PILES, BARREN HILLSIDES, AND OTHER FUGITIVE DUST SOURCE AREAS LOCATED THROUGHOUT THE SITE. SINCE SHUTDOWN OF THE SMELTER, CONTAMINANT MIGRATION PATHWAYS OF PRIMARY CONCERN ARE FUGITIVE DUST, FLOODING THAT REDEPOSITS TAILINGS INTO RESIDENTIAL AREAS, WATER EROSION THAT RESULTS IN CONTAMINATED SOIL MOVEMENT OFF OF THE HILLSIDES, AND HUMAN ACTIVITIES THAT EITHER EXACERBATE THE PREVIOUS PATHWAYS OR DIRECTLY CONTAMINATE RESIDENTIAL SOILS.

THE CURRENT PRIMARY CONTAMINANT MIGRATION MECHANISM IS AIRBORNE DEPOSITION OF CONTAMINATED DUSTS FROM FUGITIVE DUST SOURCES IN ADJACENT TO THE MINING/SMELTING COMPLEX. AIR MONITORING INFORMATION COLLECTED DURING RI/FS ACTIVITIES AND SUMMARIZED IN THE RADER INDICATES THAT AIRBORNE DUSTS TRANSPORTED INTO THE POPULATED AREAS HAVE CONCENTRATIONS RANGING FROM 1,000 TO 20,000 PPM LEAD.

TOTAL DRY AIRBORNE PARTICULATE DEPOSITION RATES AVERAGE 2,532 UG/M2/HR AND 1,768 UG/M2/HR AT THE SMELTERVILLE MINE TIMBER AND KELLOGG MIDDLE SCHOOL MONITORING SITES, RESPECTIVELY (FIGURE 5-2). WET DEPOSITION RATES AVERAGED 484 AND 487 UG/M2/HR AT THE SMELTERVILLE AND KELLOGG SITES, RESPECTIVELY. MORE THAN 80 PERCENT OF THE TOTAL PARTICULATE AND MORE THAN 90 PERCENT OF MOST METALS DEPOSITION OCCURS AS DRY DEPOSITION. THE MAXIMUM DRY DEPOSITION RATE OBSERVED WAS 12,595 UG/M2/HR AT THE MINE TIMBER SITE DURING THE SECOND WEEK OF SEPTEMBER 1988. ONLY FOUR METALS WERE OBSERVED TO HAVE DRY DEPOSITION RATES CONSISTENTLY EXCEEDING 1.0 UG/M2/HR. THOSE WERE IRON, LEAD, MANGANESE, AND ZINC WITH ANNUAL AVERAGE DEPOSITION RATES AT THE MINE TIMBER SITE OF 132, 12.7, 8.6, AND 11.3 UG/M2/HR, RESPECTIVELY. THE MAXIMUM WEEKLY LEAD DEPOSITION RATE OBSERVED WAS 83.8 UG/M2/HR AT THE MINE TIMBER SITE, ALSO OCCURRING DURING THE SECOND WEEK OF SEPTEMBER.

THE HIGHEST DEPOSITION RATES WERE OBSERVED DURING THE WEEKS THAT ALSO INCLUDED THE SEVERE DUST EVENT DAYS WITH TOTAL SUSPENDED PARTICULATES (TSP) GT 150 UG/M3 SHOWN IN TABLE 5-9. THE 1988 DATA CONFIRM THAT BOTH TOTAL SOLIDS AND CONTAMINANT PARTICULATE DEPOSITION SEEM TO BE EVENT-RELATED IN A MANNER SIMILAR TO THE TSP AND AMBIENT AIR METALS CONCENTRATION DISCUSSED IN THE LAST SECTION. AT BOTH SITES, MORE THAN 25 PERCENT OF THE TOTAL ANNUAL SOLIDS DEPOSITION OCCURRED IN FOUR INDIVIDUAL WEEKS IN 1988. THOSE INCLUDED 1 WEEK IN EACH OF MAY, AUGUST, SEPTEMBER, AND OCTOBER. THE SAME WEEKS ACCOUNTED FOR 31 PERCENT OF TOTAL LEAD, 18 PERCENT OF TOTAL CADMIUM, AND 29 PERCENT OF TOTAL ARSENIC DEPOSITION. THE 1988 SEASONAL DATA ALSO SHOWED A FREQUENCY AND MAGNITUDE OF SEVERE DUST EVENTS (TSP GT 300 UG/M3) SIMILAR TO THAT OBSERVED IN 1987, BUT ABSENT IN 1989.

THESE RESULTS SUGGEST THAT DEPOSITION, SIMILAR TO TSP, IS EVENT-RELATED WITH THE BULK OF DEPOSITED SOLIDS AND METALS COMING AS A RESULT OF HIGH WIND SPEEDS IMPACTING BARREN DUST SOURCES IN THE VICINITY OF THE MONITORS.

WATER EROSION OF HILLSIDES NEAR THE SMELTER COMPLEX IS A MIGRATION PATHWAY TO RESIDENTIAL SOIL, PARTICULARLY IN YARDS ABUTTING A HILL SLOPES. MASS LOADING RATES ARE HIGH ALONG THESE STEEP

BARREN LOCATIONS WHERE SHEET AND RILL EROSION WITH GULLING ARE SIGNIFICANT. METALS CONTENTS ON THE HILLSIDES AVERAGE 5,000 PPM LEAD.

LEAD LEACHABILITY FROM RESIDENTIAL SOILS WAS DETERMINED BY EXTRACTION PROCEDURE (EP) TOXICITY AND TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) ANALYSES. THESE TESTS ARE USED TO DETERMINE IF A MATERIAL SHOULD BE CONSIDERED A HAZARDOUS WASTE PURSUANT TO THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) AND, CONSEQUENTLY, SUBJECT TO RCRA STORAGE AND REQUIREMENTS. RESULTS SHOWED 3 OUT 23 EP TOXICITY SAMPLES EXCEEDED THE RCRA LEAD THRESHOLD LEVEL OF 5 PPM. TWO OF THE SIX TCLP SAMPLES EXCEEDED THE THRESHOLD LEVEL FOR LEAD.

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6.0 SUMMARY OF SITE RISKS

6.1 HUMAN HEALTH RISKS

THE RADER PRESENTS A DETAILED DISCUSSION OF THE RISK ASSESSMENT FOR THE POPULATED AREAS. IN THE RADER, BOTH CARCINOGENIC AND NONCARCINOGENIC EFFECTS OF CONTAMINANT EXPOSURES ARE EVALUATED. A NON-POPULATED AREAS RISK ASSESSMENT IS BEING CONDUCTED IN CONCERT WITH THE NON-POPULATED AREAS RI/FS.

6.1.1 EXPOSURE ASSESSMENT

THE CONTAMINANTS USED IN THE EXPOSURE EVALUATION AND RISK ASSESSMENT ARE ALL METALS THAT EXHIBIT: 1) ELEVATED CONCENTRATIONS IN RESIDENTIAL SOILS AND DUSTS RELATIVE TO BACKGROUND CONCENTRATIONS; 2) DECREASING CONCENTRATIONS IN ENVIRONMENTAL MEDIA WITH INCREASING DISTANCE FROM THE INDUSTRIAL COMPLEX; AND 3) POTENTIAL FOR HUMAN TOXICITY FOLLOWING INCIDENTAL AND CHRONIC EXPOSURES. CONTAMINANTS OF CONCERN INCLUDE ANTIMONY, ARSENIC, CADMIUM, COPPER, LEAD, MERCURY, AND ZINC.

RECEPTOR POPULATIONS AT RISK ARE IDENTIFIED AS THE CURRENT AND PAST RESIDENTS OF THE POPULATED AREAS OF THE SITE. THREE GROUPS HAVE BEEN EVALUATED IN TERMS OF CONTAMINANT EXPOSURES AND CONSEQUENT RISKS. THESE ARE:

1. A GENERAL POPULATION OF RESIDENTS THAT ARE ASSUMED TO LIVE, SINCE BIRTH, UNDER THE CONDITIONS REPRESENTED BY THE CONTAMINATION LEVELS FOUND SINCE 1983 FOR A 70-YEAR LIFETIME (REFERRED TO AS THE CURRENT SCENARIO WHICH WOULD ALSO BE A FUTURE SCENARIO UNDER THE NO ACTION ALTERNATIVE).
2. A GENERAL POPULATION OF RESIDENTS WHO WERE BORN IN 1971 AND WERE 2 YEARS OLD DURING THE PERIOD OF MAXIMUM EXPOSURE ONSITE AND WHO REMAIN ONSITE UNDER CURRENT CONDITIONS FOR A 70-YEAR LIFETIME (REFERRED TO AS THE HISTORICAL SCENARIO).
3. A SENSITIVE SUBPOPULATION OF CHILDREN EXPOSED TO LEAD

HISTORICAL EXPOSURES, SINCE 1971, WERE EVALUATED BECAUSE OF DOCUMENTED HIGH CONTAMINANT CONCENTRATIONS DURING 1973-1975. AIRBORNE LEAD CONCENTRATIONS WERE APPROXIMATELY 100 TIMES GREATER DURING THIS PERIOD THAN CURRENT LEVELS. CONSIDERATION OF THESE EXPOSURES IS CRITICAL FOR EVALUATING THE POTENTIAL CHRONIC RISKS OF METAL CONTAMINANTS ON THE POPULATION.

BOTH THE CURRENT AND HISTORICAL POPULATIONS (NUMBERS 1 AND 2 ABOVE) ARE REPRESENTATIVE OF BASELINE CONDITIONS -- THOSE CONDITIONS UNDER WHICH NO REMEDIAL ACTION HAS BEEN UNDERTAKEN (THE NO ACTION ALTERNATIVE).

THE PRINCIPAL EXPOSURES MEDIA AND ASSOCIATED RECEPTOR PATHWAYS CHARACTERIZED FOR THE EVALUATION OF BASE-LINE HUMAN HEALTH RISK FOR THE TYPICAL RESIDENT IN THE POPULATED AREAS OF THE BUNKER HILL SITE ARE:

- ! INGESTION OF RESIDENTIAL SURFICIAL YARD SOILS
- ! INGESTION OF HOUSE DUSTS
- ! INHALATION OF AIR PARTICULATE MATTER
- ! CONSUMPTION OF NATIONAL MARKET BASKET VARIETY PRODUCE (FOODSTUFFS AVAILABLE ON SUPERMARKET SHELVES REPRESENTING FOOD OF AVERAGE CONSUMERS) AND WATER INGESTION FROM PUBLIC WATER SUPPLIES (PUBLIC WATER IS SUPPLIED FROM A SURFACE WATER SOURCE OUTSIDE SITE BOUNDARIES)

ADDITIONAL EXPOSURES THAT COULD BE EXPERIENCED BY MEMBERS OF THE POPULATION WHO ENGAGE IN POTENTIALLY HIGH-RISK ACTIVITIES ARE EVALUATED AS INCREMENTAL EXPOSURE THE FOLLOWING INCREMENTAL EXPOSURES WERE EVALUATED:

- ! CONSUMPTION OF CONTAMINATED LOCAL GROUNDWATER
- ! INGESTION OF OTHER SOIL/DUST AT EXTREME (95TH PERCENTILE CONCENTRATION) RESIDENTIAL SOIL AND HOUSE DUST CONCENTRATIONS
- ! INGESTION OF EXTREME AMOUNTS (1 GM/DAY) OF SOIL AND DUST DURING CHILDHOOD (TYPICAL OF 'PICA-TYPE' BEHAVIOR)
- ! CONSUMPTION OF LOCAL FISH FROM THE COEUR D'ALENE AREA
- ! CONSUMPTION OF LOCAL VEGETABLE GARDEN PRODUCE
- ! INHALATION OF OUTDOOR AIR PARTICULATE MATTER DURING EPISODIC, HIGH WIND EVENTS

TO DETERMINE AN INDIVIDUAL'S LEVEL OF RISK RESULTING FROM PARTICIPATION IN POTENTIALLY HIGH-RISK ACTIVITIES, THE APPROPRIATE INCREMENTAL RISK(S) WERE ADDED TO THE BASELINE ESTIMATE IF A INDIVIDUAL DOES NOT ENGAGE IN ANY OF THE INCREMENTAL ACTIVITIES EVALUATED, THEN THE RISK TO THAT INDIVIDUAL WOULD BE THE BASE-LINE ESTIMATE. THE INCREMENTAL EXPOSURE ANALYSIS CAN BE USED TO DETERMINE THE REASONABLE MAXIMUM EXPOSURE SCENARIO FOR THE POPULATED AREAS.

EXPOSURES AND CONSEQUENT RISKS WERE EVALUATED FOR EACH OF THE TWO BASELINE PERIODS (CURRENT AND HISTORICAL) IN THREE SEPARATE AREAS (SMELTERVILLE, KELLOGG/WARDNER/PAGE, AND PINEHURST) FOR THE AVERAGE OR TYPICAL POPULATION. THE RISK ASSESSMENT WAS COMPLETED ASSUMING CURRENT LAND USES WOULD CONTINUE TO BE RESIDENTIAL.

LIFETIME OR CHRONIC EXPOSURES WERE EVALUATED FOR THE TYPICAL RESIDENT BY ESTIMATING CONTAMINANT INTAKES USING AVERAGE MEDIA CONCENTRATIONS (SEE TABLE 6-1). FOR THIS EVALUATION, ARITHMETIC MEAN CONCENTRATIONS FOR EXPOSURE MEDIA WERE USED TO REPRESENT AVERAGE OR TYPICAL LONG-TERM EXPOSURE LEVELS. FOR RESIDENTIAL SOIL AND HOUSE DUST EXPOSURES, GEOMETRIC MEAN CONCENTRATIONS WERE CALCULATED AND USED FOR EVALUATING TYPICAL LONG-TERM EXPOSURES. GEOMETRIC MEAN VALUES FOR THESE MEDIA ARE EXPECTED TO BE MORE REPRESENTATIVE OF AVERAGE EXPOSURES BECAUSE OF THE STATISTICAL DISTRIBUTIONS EXHIBITED BY SOIL AND HOUSE DUST METAL CONCENTRATIONS.

CHRONIC EXPOSURES AT EXTREME LEVELS ARE NOT EXPECTED FOR THE TYPICAL RESIDENT. THEREFORE, CHRONIC EXPOSURES TO EXTREME CONCENTRATIONS OF SITE CONTAMINANTS ARE NOT EVALUATED IN THE BASELINE CHRONIC ASSESSMENT. EXTREME MEDIA CONCENTRATIONS REPRESENTED AS 95TH PERCENTILE LEVELS WERE EVALUATED AS INCREMENTAL AND SUBCHRONIC EXPOSURES.

THE TRADITIONAL APPROACH FOR RISK CHARACTERIZATION ASSOCIATED WITH LEAD EXPOSURE IS CURRENTLY INAPPROPRIATE BECAUSE AN ACCEPTABLE REFERENCE DOSE (RFD) FOR LEAD IS NOT AVAILABLE. THEREFORE, RISK CHARACTERIZATION FOR SUBCHRONIC LEAD EXPOSURE WAS ACCOMPLISHED BY USING OBSERVED CHILDHOOD POPULATION BLOOD LEAD LEVELS AND ENVIRONMENTAL MEDIA LEAD CONCENTRATIONS COLLECTED OVER THE LAST 17 YEARS IN AN INTEGRATED UPTAKE/BIOKINETIC DOSE-RESPONSE MODEL `THE MODEL WAS USED TO RELATE

CHILDHOOD BLOOD LEAD LEVELS TO CONTAMINATED MEDIA EXPOSURES. MODEL INPUTS AND CRITERIA WERE SELECTED AND VALIDATED USING SITE-SPECIFIC DATA AS DESCRIBED IN THE RADER.

TABLE 6-1 PRESENTS A SUMMARY OF CONTAMINANTS OF CONCERN, EXPOSURE ROUTES AND SOURCES, AND SCENARIOS ADDRESSED IN THE EXPOSURE EVALUATION AND RISK ASSESSMENT.

6.1.2 TOXICITY ASSESSMENT

A DETAILED DISCUSSION OF THE TOXICITY OF SITE CONTAMINANTS IS PRESENTED IN SECTION 3.5 OF THE PROTOCOL DOCUMENT. TABLE 6-2 PROVIDES A SUMMARY OF THE MOST SENSITIVE EFFECTS FOR EACH OF THE SEVEN SITE CONTAMINANTS OF CONCERN.

TABLES 6-3 AND 6-4 SUMMARIZE THE AVAILABLE CANCER POTENCY FACTORS (CPFS) AND REFERENCE DOSES (RFDS) FOR THE SITE CONTAMINANTS OF CONCERN. THESE VALUES WERE OBTAINED FROM THE HEALTH EFFECTS SUMMARY TABLES AND INTEGRATED RISK INFORMATION SYSTEM.

6.1.3 RISK CHARACTERIZATION

6.1.3.1 CARCINOGENIC RISK

EXCESS LIFETIME CANCER RISKS ARE DETERMINED BY MULTIPLYING THE INTAKE LEVEL WITH THE CANCER POTENCY FACTOR. THESE RISKS ARE PROBABILITIES THAT ARE GENERALLY EXPRESSED IN SCIENTIFIC NOTATION (E.G., $1 \times (10^{-6})$). AN EXCESS LIFETIME CANCER RISK OF $1 \times (10^{-6})$ MEANS THAT IF A POPULATION OF 1 MILLION PEOPLE WERE EXPOSED TO THE BASELINE CONDITION OVER A 70-YEAR LIFETIME, IT IS EXPECTED THAT THERE WOULD BE ONE ADDITIONAL CANCER ABOVE THE CANCER EVENTS DUE TO OTHER CAUSES. THE CURRENT US CANCER RATE IS ONE IN FOUR. THEREFORE, IN A POPULATION OF 1 MILLION PEOPLE, 250,000 CANCER EVENTS ARE PREDICTED. UNDER A (10^{-6}) RISK SCENARIO, 250,001 CANCER EVENTS WOULD BE PREDICTED.

RESULTS OF THE CHRONIC EXPOSURE AND RISK CHARACTERIZATION INDICATE THAT EXCESS (ABOVE BACKGROUND) CARCINOGENIC RISK IS ASSOCIATED WITH BASELINE EXPOSURES AND CONSEQUENT INTAKES FOR ARSENIC AND CADMIUM IN AIR. TOTAL BASELINE (70-YEAR LIFETIME) RISK TO LUNG CANCER, DUE TO INHALATION OF ARSENIC AND CADMIUM UNDER CURRENT SITE CONDITIONS, IS FROM 2 TO 32 TIMES GREATER THAN FOR OFFSITE BACKGROUND. UNDER THE HISTORICAL SCENARIO, RISK TO LUNG CANCER WAS TWO TO SIX TIMES GREATER THAN THE CURRENT SCENARIO FOR THE SAME COMMUNITIES. BASELINE CANCER RISK ESTIMATES INDICATE THAT THE TYPICAL POPULATION EXCEEDS USEPA'S ACCEPTABLE RANGE FOR CANCER RISK (10^{-4}) TO (10^{-6}) .

ACCEPTABLE LEVELS OF RISK TO LUNG CANCER MAY NEVER BE ATTAINED AT ANY FUTURE ARSENIC AND CADMIUM AIR LEVELS FOR THOSE INDIVIDUALS WHO HAVE HAD CONSIDERABLE HISTORICAL AND CUMULATIVE EXPOSURES. TUMOR REGISTRY DATA SUPPORT THE PRESENCE OF A DISEASE-CAUSING AGENT FOR THE INCREASED OCCURRENCE OF RESPIRATORY CANCERS IN THE AREA.

BASELINE CARCINOGENIC RISK DUE TO SITE EXPOSURES IS APPROXIMATELY 30 PERCENT GREATER THAN BACKGROUND CARCINOGENIC RISK $9.8 \times (10^{-4})$. BASELINE CARCINOGENIC RISK IN CONJUNCTION WITH THE CONSUMPTION OF SITE GROUNDWATER IN SMELTERVILLE AND KELLOGG DUE TO ARSENIC INTAKES COULD RESULT IN A DOUBLING OF THE RISK ASSOCIATED WITH BACKGROUND EXPOSURE. EXCESS HEALTH RISK DUE TO ARSENIC IN GROUNDWATER MAKES THIS SOURCE UNSUITABLE FOR DRINKING IN MANY AREAS OF THE SITE. GROUNDWATER IS NOT CURRENTLY USED AS A MUNICIPAL DRINKING WATER SOURCE.

TABLE 6-5 PRESENTS A SUMMARY OF THE BASELINE AND INCREMENTAL CARCINOGENIC RISK ESTIMATES.

6.1.3.2 NONCARCINOGENIC RISK

POTENTIAL CONCERN FOR NONCARCINOGENIC EFFECTS OF A SINGLE CONTAMINANT IN A SINGLE MEDIUM IS EXPRESSED AS THE HAZARD QUOTIENT (HQ). BY ADDING THE HQS FOR ALL CONTAMINANTS WITHIN A MEDIUM OR ACROSS ALL MEDIA TO WHICH A GIVEN POPULATION MAY REASONABLY BE EXPOSED, THE HAZARD INDEX (HI) CAN BE GENERATED. THE HI PROVIDES A USEFUL REFERENCE POINT FOR GAUGING THE POTENTIAL SIGNIFICANCE OF MULTIPLE CONTAMINANTS EXPOSURES WITHIN A SINGLE MEDIUM OR ACROSS MEDIA. EXCESS RISK IS DETERMINED TO BE WHERE THE HI IS GREATER THAN OR EQUAL TO 1.0.

ALL ESTIMATED BASELINE NONCARCINOGENIC RISKS FOR SPECIFIC TOXIC ENDPOINTS AND TARGET ORGANS RESULTING FROM ORAL INTAKES OF SITE CONTAMINANTS OF CONCERN HAVE BEEN DETERMINED TO BE ACCEPTABLE (HI LT 1).

POTENTIAL ACTIVITIES THAT COULD RESULT IN UNACCEPTABLE RISK TO NONCARCINOGENIC DISEASE ARE ASSOCIATED WITH METAL INTAKES RESULTING FROM CONSUMPTION OF SITE GROUNDWATER, EXCESSIVE SOIL AND DUST INGESTION BY CHILDREN, AND CONSUMPTION OF LOCAL GARDEN PRODUCE.

TABLE 6-6 PRESENTS THE SUMMARY OF EXCESS RISKS EVALUATED IN THE NONCARCINOGENIC RISK ASSESSMENT.

6.1.3.3 SUBCHRONIC EXPOSURE

THE MOST RECENT LEAD HEALTH SURVEY OF AREA CHILDREN INDICATES THAT CURRENT BLOOD LEAD LEVELS FOR MANY CHILDREN EXCEED LEVELS AT WHICH ADVERSE HEALTH EFFECTS ARE ASSOCIATED. IN 1990, 2 OF 362 CHILDREN HAD BLOOD LEAD LEVELS EXCEEDING 25 UG/DL. FIFTY PERCENT OF THE CHILDREN WITHIN A APPROXIMATE 2-MILE RADIUS OF THE INDUSTRIAL COMPLEX HAD BLOOD LEAD LEVELS EXCEEDING 10 UG/DL. THIRTY PERCENT OF THE CHILDREN WITHIN THE 2- TO 3-MILE RADIUS OF THE INDUSTRIAL COMPLEX HAD BLOOD LEAD LEVELS EXCEEDING 10 UG/DL.

CDC'S 1985 HEALTH ADVISORY FOR BLOOD LEAD LEVEL STATES THAT "A BLOOD LEAD LEVEL IN CHILDREN OF 25 UG/DL OR ABOVE INDICATES EXCESSIVE LEAD ABSORPTION AND CONSTITUTES GROUNDS FOR MEDICAL INTERVENTION." RECENT INFORMATION INDICATES THAT ADVERSE HEALTH EFFECTS ARE ASSOCIATED WITH BLOOD LEAD LEVELS AT 10 TO 15 UG/DL, OR POSSIBLY LOWER. CDC IS EXPECTED TO ESTABLISH 10 UG/DL AS THE LEVEL ABOVE WHICH ACTION SHOULD BE TAKEN. IN ADDITION, ATSDR IS SUPPORTIVE OF THE GOAL OF REDUCING CHILDHOOD BLOOD LEAD LEVELS TO BELOW 10 UG/DL.

A REVIEW OF PAST EXPOSURES AND HEALTH SURVEY DATA AT THE BUNKER HILL SITE INDICATES THAT DURING EXTREME EXPOSURES IN THE EARLY TO MID-1970S, UP TO 80 PERCENT OF THE CHILDREN EXHIBITED BLOOD LEAD LEVELS THAT ARE ASSOCIATED WITH ADVERSE NEUROBEHAVIORAL DEVELOPMENT THAT PERSISTS INTO YOUNG ADULTHOOD. ADDITIONAL CONCERN FOR PAST LEAD EXPOSURES (PRIOR TO SMELTER CLOSURE IN 1981) IS DUE TO THE POTENTIAL RELEASE OF LEAD FROM NORMAL BONE RESORPTION DURING PREGNANCY AND LACTATION AND THE RESULTANT PRO- AND POST-NATAL EXPOSURES TO CHILDREN WHO ARE BORN TODAY OF MOTHERS WHO WERE EXPOSED AS CHILDREN IN THE 1970S.

SUBCHRONIC EXPOSURES AND CONSEQUENT INTAKES COULD INCREASE HEALTH RISKS IN THE SHORT TERM TO LEVELS WELL ABOVE THOSE ESTIMATED FOR BASELINE CHRONIC RISK. INGESTION OF EXTREME AMOUNTS OF SOIL AND DUST DURING CHILDHOOD (AGES 2 TO 6 YEARS), CHARACTERIZED AS "PICA-TYPE" BEHAVIOR, COULD YIELD UP TO 10 TIMES GREATER METAL INTAKES THAN FOR THE TYPICAL CHILD. THESE EXTREME INTAKES DUE TO SOIL/DUST INGESTION COULD AMOUNT TO APPROXIMATELY 2 MG PB/DAY, RESULTING IN DANGEROUS BLOOD LEAD INCREASES IN YOUNG CHILDREN. "PICA-TYPE" BEHAVIOR COULD PRESENT EXTREME RISK TO THIS HIGHLY SUSCEPTIBLE SUB-GROUP OF THE POPULATION, AND REQUIRES CONTROL IF OBSERVED.

CONSUMPTION OF LOCAL GARDEN PRODUCE CAN YIELD EXTREME INTAKES OF CADMIUM, LEAD AND ZINC. UP TO 220 TIMES AS MUCH LEAD CAN BE INGESTED FROM THE CONSUMPTION OF LOCAL GARDEN VEGETABLES GROWN IN SMELTERVILLE AND KELLOGG VERSUS THAT ASSOCIATED WITH THE CONSUMPTION OF NATIONAL MARKET BASKET

VARIETY PRODUCE. CHILDREN AND PREGNANT WOMEN (AS SURROGATES TO THE FETUS) ARE MOST SUSCEPTIBLE TO THE ADVERSE EFFECTS ASSOCIATED WITH CONSEQUENT LEAD INTAKES. UP TO 62 TIMES AS MUCH CADMIUM CAN BE CONSUMED IN LOCAL GARDEN PRODUCE VERSUS MARKET BASKET VARIETY PRODUCE, THUS PRESENTING UNACCEPTABLE CHRONIC AND SUBCHRONIC RISK TO RENAL DISEASE.

6.1.4 HUMAN HEALTH RISK SUMMARY

IN SUMMARY, THE CONCLUSIONS OF THE RADER STATE THAT CURRENT SITE CONDITIONS PRESENT AN ENVIRONMENT WHERE THERE ARE EXCESSIVE RISKS ASSOCIATED WITH SEVERAL DIFFERENT EXPOSURE PATHWAYS. THESE ARE:

- ! CARCINOGENIC RISK ASSOCIATED WITH EXPOSURE TO:
 - ARSENIC VIA POTENTIAL GROUNDWATER CONSUMPTION
 - ARSENIC AND CADMIUM VIA INHALATION

- ! CHRONIC NONCARCINOGENIC RISK ASSOCIATED WITH EXPOSURE TO:
 - ARSENIC, CADMIUM, AND ZINC VIA POTENTIAL GROUNDWATER CONSUMPTION
 - ANTIMONY, CADMIUM, MERCURY, AND LEAD VIA EXCESSIVE SOIL AND DUST INGESTION (CHARACTERIZED BY "PICA-TYPE" BEHAVIOR)
 - CADMIUM AND LEAD VIA LOCAL GARDEN PRODUCE CONSUMPTION

- ! SUBCHRONIC NONCARCINOGENIC RISK ASSOCIATED WITH EXPOSURE TO:
 - LEAD VIA INGESTION OF SOIL AND DUST
 - CADMIUM, LEAD, AND ZINC VIA LOCAL GARDEN PRODUCE CONSUMPTION

SUBCHRONIC LEAD ABSORPTION AMONG YOUNG CHILDREN IS THE MOST SIGNIFICANT HEALTH RISK POSED BY THIS SITE. THE MAJOR ROUTES FOR LEAD ABSORPTION ARE:

- ! INGESTION OF CONTAMINATED SOILS IN RESIDENTIAL YARDS AND OTHER RESIDENTIAL ENVIRONS

- ! INGESTION OF CONTAMINATED HOUSE DUSTS THAT ARE RESULTANT FROM TRACKING OF RESIDENTIAL SOILS AND DEPOSITION OF AIRBORNE PARTICULATE

- ! INHALATION AND INGESTION OF AIRBORNE PARTICULATE MATTER DERIVED FROM FUGITIVE DUST SOURCES THROUGHOUT THE SITE

6.1.5 THE 1,000 PPM THRESHOLD CLEANUP LEVEL

A REMEDIAL ACTION OBJECTIVE FOR THIS OPERABLE UNIT IS TO DECREASE THE EXPOSURE TO LEAD-CONTAMINATED RESIDENTIAL SOILS SUCH THAT 95 PERCENT OR MORE OF THE CHILDREN IN THE AREA HAVE BLOOD LEAD LEVELS BELOW 10 UG/DL AND THAT LESS THAN ONE PERCENT HAVE BLOOD LEADS GREATER THAN 15 UG/DL. THE 1,000 PPM LEAD CLEANUP THRESHOLD LEVEL SELECTED FOR YARD SOIL REMEDIATION AT BUNKER HILL IS A SITE-SPECIFIC AND MEDIA-SPECIFIC VALUE CHOSEN TO MEET THESE OBJECTIVES. THIS LEVEL IS NOT A TARGET EXPOSURE CONCENTRATION. RATHER, IT IS THE MAXIMUM SOIL LEAD LEVEL THAT ANY CHILD MAY BE EXPOSED TO IN HIS OR HER HOME YARD. THIS SHOULD NOT BE CONSTRUED TO SUGGEST THAT THIS LEVEL IS HEALTH PROTECTIVE FOR SOILS AT OTHER SITES, OR OTHER SOIL AND DUST MEDIA AT THE BUNKER KILL SITE. A CHILD LIVING ON AN UNREMIEDIATED YARD OF 1,000 PPM IS ESTIMATED TO HAVE A 0.1 TO 2.5 PERCENT (DEPENDING ON VARIOUS ASSUMPTIONS) CHANCE OF EXCEEDING 15 UG/DL BLOOD LEAD IN THE BUNKER HILL POST-REMEDICATION ENVIRONMENT. THE FOLLOWING ARE SEVERAL REASONS WHY THIS SOLUTION APPLIES ONLY FOR RESIDENTIAL YARD SOILS AND ONLY AT THIS PARTICULAR SITE:

RESPONSE RATE: THE RESPONSE RATE VALUE FOR THIS SITE WAS ARRIVED AT AFTER EXTENSIVE REVIEW OF EPIDEMIOLOGIC AND ENVIRONMENTAL DATA COLLECTED AT THE SITE FOR MORE THAN 15 YEARS. ANALYSES OF THOSE DATA SUGGEST THAT THE DOSE-RESPONSE RELATIONSHIP BETWEEN CONTAMINATED SOILS AND DUSTS AND RESULTANT BLOOD LEAD LEVELS IN CHILDREN IS ABOUT HALF THAT OBSERVED AT OTHER LEAD-CONTAMINATED SITE. WHETHER THE LESSER RESPONSE RATE IS DUE TO REDUCED INTAKE (LOWER SOILS AND DUST INGESTION RATES) OR REDUCED UPTAKES (LESSER ABSORPTION OF INGESTED LEAD IN SOILS) CANNOT BE DISCERNED FROM THE DATA. THE SELECTION OF THE 1,000 PPM THRESHOLD LEVEL ASSUMES THE LATTER (I.E., REDUCED ABSORPTION RATES AT THIS SITE).

TOTAL LEAD INTAKE: PREDICTED BLOOD LEAD LEVELS RESULTANT FROM REMEDIAL ACTIVITIES ARE BASED ON TOTAL LEAD INTAKE FROM ALL MEDIA. THE FOUR PRINCIPAL PATHWAYS ARE LEAD IN DIET, DRINKING WATER, AIR, AND SOILS AND DUSTS. THE EFFECTIVENESS OF THE 1,000 PPM THRESHOLD LEVEL FOR YARD SOILS IS DEPENDENT ON SEVERAL ASSUMPTIONS REGARDING REDUCED INTAKES ALONG OTHER PATHWAYS. SOME OF THOSE ASSUMPTIONS ARE BASED ON ASSESSMENTS OF OTHER REMEDIAL ACTIVITIES ON THE SITE AND SUBSTANTIAL REDUCTIONS IN DIETARY INTAKE ACHIEVED FROM NATIONWIDE LEAD REDUCTION INITIATIVES. THOSE ASSUMPTIONS MAY NOT APPLY TO OTHER SITES.

COMPOSITE SOIL/DUST LEAD CONCENTRATIONS: ANALYSES PRESENTED IN THE RADER SUGGEST THAT THE COMPOSITE CONCENTRATIONS OF LEAD IN ALL THE SOILS AND DUSTS INGESTED BY CHILDREN MUST BE REDUCED TO 700 TO 1,200 PPM AT THIS SITE TO MEET THE REMEDIAL ACTION OBJECTIVE OF LESS THAN 5 PERCENT OF CHILDREN HAVING A BLOOD LEAD OF GREATER THAN 10 UG/DL. THERE ARE SEVERAL CONTRIBUTING SOURCES TO THIS OVERALL SOIL AND DUST LOADING. THOSE INCLUDE YARD SOILS, HOUSE DUSTS, ROAD DUSTS, PLAY AREA SOILS, FUGITIVE DUST SOURCES, AND OTHER SOILS IN THE COMMUNITY WHERE CHILDREN MAY CONGREGATE. RESIDENTIAL YARD SOILS ARE A IMPORTANT COMPONENT OF THE OVERALL SOIL AND DUST LOADING, A SUBSTANTIAL PORTION OF CHILDREN'S EXPOSURE RESULTS FROM DIRECT CONTACT IN THE YARD. A SUBSTANTIAL PORTION OF HOUSE DUST LOADING RESULTS FROM YARD SOILS TRANSPORTED INTO THE HOME AND ADDITIONAL CHILDREN'S EXPOSURE RESULTS FROM VISITS TO YARDS OTHER THAN THEIR OWN HOME. YARD SOILS MAY ALSO BE A SOURCE OF CONTAMINATED DUSTS CIRCULATING THROUGH THE COMMUNITY VIA AIR, WATER, AND MECHANICAL PATHWAYS. REMOVING ALL YARD SOILS GREATER THAN 1,000 PPM WILL HAVE POSITIVE EFFECTS ALONG ALL THESE PATHWAYS AND ROUTES OF EXPOSURE. HOWEVER, ACHIEVING THE REMEDIAL ACTION OBJECTIVES WILL REQUIRE ADDITIONAL ACTIVITIES AMONG THE SOIL AND DUST SOURCES OTHER THAN YARD SOILS. THOSE ACTIONS ARE SPECIFIC TO THIS SITE AND MAY NOT BE APPLICABLE TO OTHER LOCALES.

DISTRIBUTION OF YARD SOIL LEAD CONCENTRATION: THE EFFECTIVENESS OF THE CLEANUP STRATEGY IN MEETING REMEDIAL ACTION OBJECTIVES DEPENDS ON THE POST-REMEDICATION DISTRIBUTION OF CONTAMINANT LEVELS. THAT DISTRIBUTION WILL BE SITE-SPECIFIC AND, LIKELY, INAPPLICABLE TO OTHER LOCATIONS. THE IMPOSITION OF THE 1,000 PPM CLEANUP THRESHOLD AT THE BUNKER HILL SITE WILL RESULT IN REMEDIATION OF MORE THAN 75 PERCENT OF THE YARDS IN MOST RESIDENTIAL AREAS. THE MEAN YARD SOIL LEAD CONCENTRATIONS IN AREA COMMUNITIES WILL BE REDUCED FROM NEARLY 3,000 PPM TO LESS THAN 200 TO 300 PPM. THIS REPRESENTS A TREMENDOUS REDUCTION IN TOTAL ENVIRONMENTAL LEAD LOADING IN THE COMMUNITY AND SHOULD HAVE POSITIVE EFFECTS IN OTHER MEDIA AS WELL. SUBSTANTIAL BENEFIT WILL RESULT IN THE FORM OF REDUCED EXPOSURE FROM SEVERAL SOURCES.

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

6.2 ENVIRONMENTAL RISKS

THIS RECORD OF DECISION ADDRESSES THE REMEDIATION OF RESIDENTIAL SOILS WITHIN THE POPULATED AREAS OF THE BUNKER HILL SUPERFUND SITE. THERE ARE NO CRITICAL HABITATS OR ENDANGERED SPECIES OR HABITATS AFFECTED BY RESIDENTIAL SOILS CONTAMINATION OR ANTICIPATED EFFECTS CAUSED BY FUTURE REMEDIATION. AN ECOLOGICAL RISK ASSESSMENT IS BEING CONDUCTED AS PART OF THE NON-POPULATED

AREAS RI/FS.

THE URBAN COMPONENT OF THE ECOSYSTEM AT BUNKER HILL HAS BEEN IMPACTED BY HISTORICAL MINING AND SMELTING ACTIVITIES. THE AVERAGE HEAVY METAL CONCENTRATIONS IN RESIDENTIAL SOILS AND COMMUNITY ROAD SHOULDERS ARE HIGHER THAN ON THE HILLSIDES PORTION OF THE SITE. MANY OF THE RESIDENTIAL SOILS HAVE METAL CONCENTRATIONS CAPABLE OF INDUCING TOXICOLOGICAL EFFECTS ON SOIL MICRO-ORGANISMS, INVERTEBRATES, AND PLANT. COMPARATIVE CONCENTRATIONS IN VARIOUS OTHER SOIL TYPES HAVE RESULTED IN REDUCED PRODUCTIVITY, YIELDS, DECOMPOSITION, AND NUTRIENT CYCLING RATES. OTHER ANIMALS THAT INHABIT THE URBAN AREAS SUCH AS HOUSE MICE AND SQUIRRELS, AS WELL AS CATS AND DOGS, ARE SUSCEPTIBLE TO INGESTION OF RESIDENTIAL SOILS WITH AN INCREASED RISK OF CHEMICAL STRESS.

MANAGEMENT OF SOIL AND VEGETATION AT BUNKER HILL CAN FACILITATE NATURAL AND FAVORABLE CONDITIONS WITHIN THE URBAN ECOSYSTEM BY REDUCING THE MOBILITY OF CONTAMINANTS AND THEIR POTENTIAL FOR INDUCING CHEMICAL STRESS. THE REPLACEMENT OF RESIDENTIAL SOILS AND VEGETATION IS ACTED TO ENHANCE THE MICRO-HABITAT NICHES FOR THE FLORA AND FAUNA THAT USE THEM.

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7.0 DETAILED DESCRIPTION OF ALTERNATIVES

THIS PROPOSED CLEANUP ACTION INVOLVES RESIDENTIAL YARDS, AN AREA THAT IS TYPICALLY USED FOR MANY DIFFERENT ACTIVITIES AND PURPOSES. WHILE IT IS IMPORTANT THAT THE CLEANUP ACTION BLOCK THE ROUTES BY WHICH PEOPLE COME IN CONTACT WITH CONTAMINANTS IN THE SOIL, IT IS ALSO IMPORTANT THAT THE CLEANUP ACTION ALLOW RESIDENTS TO USE THEIR YARDS FOR THEIR MANY PURPOSES. FOR EXAMPLE, WHILE A CONCRETE OR ASPHALT LAYER WOULD BLOCK THE PATHWAY BETWEEN THE CONTAMINATION AND RESIDENTS, IT WOULD MAKE IT IMPOSSIBLE FOR RESIDENTS TO USE THEIR YARDS FOR TYPICAL ACTIVITIES, SUCH AS PLANTING AND GARDENING. THEREFORE, EXCEPT FOR THE NO ACTION ALTERNATIVE, ALL OF THE ALTERNATIVES ARE DESIGNED TO REDUCE HUMAN EXPOSURE TO CONTAMINATION, WHILE MAINTAINING THE INTEGRITY OF THE INDIVIDUAL YARDS.

7.1 ALTERNATIVE 1 -- NO ACTION

THE NO ACTION ALTERNATIVE PROVIDES A BASELINE FOR COMPARING AGAINST OTHER ALTERNATIVES. THE SITE WOULD BE LEFT IN ITS CURRENT CONDITION. EXISTING INSTITUTIONAL CONTROLS, SUCH AS THE HEALTH INTERVENTION PROGRAM, WOULD BE DISCONTINUED. BECAUSE NO REMEDIAL ACTIVITIES WOULD BE IMPLEMENTED WITH THE NO ACTION ALTERNATIVE, LONG-TERM HUMAN HEALTH AND ENVIRONMENTAL RISKS FROM RESIDENTIAL SOILS AT THE SITE WOULD BE ESSENTIALLY THE SAME AS THOSE IDENTIFIED IN THE RADER:

- ! SIGNIFICANT HEALTH RISKS TO YOUNG CHILDREN ASSOCIATED WITH EXPOSURE TO INGESTION OF CONTAMINATED SOIL, INGESTION OF CONTAMINATED HOUSE DUSTS, AND INHALATION AND INGESTION OF AIRBORNE PARTICULATE MATTER WOULD MAINTAIN CURRENTLY UNACCEPTABLE HEALTH CONDITIONS AND COULD RESULT IN DANGEROUS BLOOD LEAD INCREASES IN YOUNG CHILDREN.
- ! EXCESSIVE SOIL AND DUST INGESTION BY "PICA-TYPE" CHILDREN COULD RESULT IN TOXIC EFFECTS DUE TO ANTIMONY, CADMIUM, AND LEAD.
- ! CONSUMPTION OF LOCAL PRODUCE CAN INCREASE INTAKES OF CADMIUM, LEAD, AND ZINC, RESULTING IN NEUROLOGICAL AND RENAL DISEASE.

UNACCEPTABLE HIGH BLOOD LEAD CONCENTRATIONS IN SOME CHILDREN WOULD PROBABLY CONTINUE AND THE POTENTIAL FOR INCREASES IN BLOOD LEAD CONCENTRATIONS COULD INCREASE BECAUSE OF THE TERMINATION OF THE HEALTH INTERVENTION PROGRAM.

ENVIRONMENTAL MONITORING WOULD BE CONDUCTED UNDER THE NO ACTION ALTERNATIVE. THE PURPOSE OF THE MONITORING WOULD BE TO DETECT CHANGES IN ENVIRONMENTAL CONDITIONS OVER TIME. ENVIRONMENTAL MONITORING WOULD OCCUR FOR THE FOLLOWING MEDIA:

MEDIA	PARAMETERS
AIR	SUSPENDED PARTICULATES, PB AND AS CONCENTRATIONS
RESIDENTIAL SOILS	CONTAMINANT METALS CONCENTRATIONS

SAMPLING LOCATIONS WOULD BE CONSISTENT WITH PREVIOUS SAMPLE COLLECTION SITES TO PROVIDE A BASIS FOR HISTORIC COMPARISONS. IN ADDITION TO MONITORING ENVIRONMENTAL MEDIA, IT IS EXPECTED THAT CHILDREN'S BLOOD WOULD CONTINUE TO BE SCREENED FOR LEAD.

7.2 COMMON COMPONENTS OF ALTERNATIVES

- 3 -- VARIABLE CUT/REMOVE/FILL/DISPOSAL;
- 5 -- SOD REMOVAL/SOD REPLACEMENT/DISPOSAL;
- 6 -- DEEP REMOVAL/FILL/DISPOSAL; AND
- 8 -- VARIABLE CUT/REMOVE/FILL/TREAT/DISPOSAL

ALL OF THE REMAINING ALTERNATIVES HAVE COMPONENTS IN COMMON (USE OF INSTITUTIONAL CONTROLS, REVEGETATION, DUST SUPPRESSION, EXCAVATION/BACKFILL, EXTENT OF REMEDIATION, DISPOSAL AND MONITORING). ALTHOUGH THE DESCRIPTION OF THESE COMPONENTS IS NOT REPEATED IN THE DISCUSSIONS FOR EACH ALTERNATIVE, DIFFERENCES IN THEIR PLANNED IMPLEMENTATION ARE IDENTIFIED WHERE APPROPRIATE. ARARS FOR ALL ALTERNATIVES ARE SIMILAR AND ARE DISCUSSED IN SECTION 10. EACH OF THESE COMMON COMPONENTS IS DISCUSSED BELOW.

7.2.1 INSTITUTIONAL CONTROLS

INSTITUTIONAL CONTROLS WOULD BE IMPLEMENTED TO A CERTAIN DEGREE WITH EACH ALTERNATIVE. THE RELIANCE ON INSTITUTIONAL CONTROLS IS DEPENDENT ON THE REMEDIAL ACTION TECHNOLOGIES EMPLOYED AND THEIR LONG-TERM EFFECTIVENESS IN PROTECTING HUMAN HEALTH AND THE ENVIRONMENT. THE DETAILED EVALUATION OF THE PROPOSED INSTITUTIONAL CONTROLS ARE INCLUDED IN THE DOCUMENT ENTITLED 'AN EVALUATION OF INSTITUTIONAL CONTROLS FOR THE POPULATED AREAS OF THE BUNKER HILL SUPERFUND SITE', WHICH IS PART OF THE RESIDENTIAL SOILS ADMINISTRATIVE RECORD.

THE RANGE OF INSTITUTIONAL CONTROLS CONSISTS OF THE FOLLOWING COMPONENTS:

- ! DEED NOTICES
- ! PUBLIC EDUCATION
- ! EXCAVATION REGULATIONS AND PERMITS
- ! HEALTH INTERVENTION PROGRAM
- ! CONTAMINATED SOIL COLLECTION SYSTEM
- ! CLEAN SOIL SUPPLY SYSTEM
- ! POST-CLEANUP ADMINISTRATION AND EVALUATION
- ! SOD MAINTENANCE ORDINANCES
- ! LAWN MAINTENANCE CONTRACTING

7.2.2 REVEGETATION

REVEGETATION OF RESIDENTIAL YARDS IS A COMPONENT OF EACH ALTERNATIVE. THE LAWN AREAS OF REMEDIATED YARDS WOULD GENERALLY BE REVEGETATED WITH SOD. STEEP HILLSIDES AND OTHER REMEDIATED

AREAS NOT CURRENTLY PLANTED WITH LAWNS (SUCH AS VACANT LOTS) WOULD BE STABILIZED AND HYDROSEEDED WITH NATIVE GRASSES. NATIVE GRASSES REQUIRE LESS MAINTENANCE AND ARE MORE TOLERANT OF THE LOCAL CLIMATIC CONDITIONS. IF PREFERRED BY A PROPERTY OWNER, HYDROSEEDING WITH NATIVE COULD BE SUBSTITUTED FOR THE SOD. TO THE EXTENT PRACTICABLE, ALL YARD LANDSCAPING WOULD BE RETURNED TO ITS ORIGINAL CONDITION.

7.2.3 DUST SUPPRESSION DURING REMEDIATION

DUST SUPPRESSION MEASURES WOULD BE IMPLEMENTED THROUGHOUT THE REMEDIATION PROCESS TO REDUCE EXPOSURE OF WORKERS AND RESIDENTS TO AIRBORNE CONTAMINANTS. DUST SUPPRESSION WOULD INCLUDE:

- ! WATERING OF RESIDENTIAL YARD AREAS PRIOR TO EXCAVATION ACTIVITIES
- ! CONTINUED WATERING DURING EXCAVATION, AS NECESSARY
- ! PLACEMENT OF TARPS OR COVERT OVER EXCAVATED MATERIALS
- ! USE OF TARPS OR COVERS OVER TRUCK BEDS TO REDUCE BLOWING DUST AND SPILLAGE DURING TRANSPORTATION TO THE WASTE REPOSITORY
- ! DAILY CLEANUP OF ALL SPILLED OR TRACKED SOILS FROM SIDEWALKS, ROADWAYS, ETC

APPROPRIATE AIR MONITORING WOULD BE CONDUCTED TO IDENTIFY THE OCCURRENCE OF CONTAMINANT MIGRATION DURING REMEDIAL ACTIVITIES. ANY EXCEEDANCES OF THE STANDARDS WOULD RESULT IN IMMEDIATE IMPLEMENTATION OF ADDITIONAL DUST SUPPRESSION MEASURES OR A SHUTDOWN OF CONSTRUCTION ACTIVITIES.

7.2.4 EXCAVATION/BACKFILL/COVER

FOR ALL ALTERNATIVES, REMEDIATION OF RESIDENTIAL YARDS WOULD BE COMPLETED BY EITHER COVERING WITH A LAYER OF UNCONTAMINATED SOIL OR BY REMOVING AND REPLACING CONTAMINATED SOIL OR SOD WITH UNCONTAMINATED MATERIALS.

A RANGE OF ALTERNATIVES WAS DEVELOPED TO PROVIDE DECISION MAKERS WITH SEVERAL OPTIONS. ALTERNATIVE 5 IS AN OPTION WITH MINIMAL SOIL REMOVAL AND REPLACEMENT. A 12-INCH REMOVAL AND REPLACEMENT IS PRESENTED IN ALTERNATIVE 3. A 6-INCH SOIL BARRIER WAS CONSIDERED DURING THE DEVELOPMENT OF ALTERNATIVE 3. HOWEVER, IT WAS CONCLUDED THAT A 6-INCH DEPTH IS INSUFFICIENT TO PROVIDE A VIABLE OPTION AS A BARRIER TECHNOLOGY IN A RESIDENTIAL AREA, IF THE UNDERLYING MATERIAL IS CONTAMINATED. THIS IS BECAUSE A 6-INCH BARRIER COULD BE PENETRATED BY SUCH COMMON OCCURRENCES AS A DIGGING DOG, A HOMEOWNER PLANTING BULBS, OR CHILDREN'S PLAY ACTIVITIES. TO COMPLETE THE RANGE OF ALTERNATIVES, ALTERNATIVE 6 WAS DEVELOPED TO EVALUATE DEEP REMOVAL OF CONTAMINATED MATERIALS.

7.2.5 EXTENT OF REMEDIATION

FOR ALL OF THE ALTERNATIVES, THE AREAL EXTENT OF REMEDIATION WOULD BE CONSISTENT. FOR EACH RESIDENTIAL YARD, THE EXACT NATURE OF THE REMEDIATION (E.G., HOW MUCH SOD TO REPLACE, WHICH BUSHES TO REMOVE, ETC) WOULD HAVE TO BE CONSIDERED ON A CASE-BY-CASE BASIS. HOWEVER, FOR CONSISTENCY, THE FOLLOWING AREAS WOULD GENERALLY BE REMEDIATED WITHIN EACH YARD:

- ! SOD AREAS
- ! ROADWAY SHOULDERS (IF CURB AND GUTTER IS NOT PRESENT) TO THE EXTENSION OF THE LOT LINES
- ! ALLEYS (IF UNPAVED) TO THE EXTENSION OF THE LOT LINES PLANTERS AND OTHER

- ! LANDSCAPED AREAS
- ! GARDEN AREAS
- ! UNPAVED DRIVEWAYS
- ! GARAGES WITH DIRT FLOORS
- ! STORAGE AREAS

IN SHORT, REMEDIATION WOULD OCCUR IN ANY AREA WITHIN AND ADJACENT TO THE RESIDENTIAL YARD WHERE CHILDREN COULD PLAY AND COULD POTENTIALLY COME IN CONTACT WITH CONTAMINATED SOILS. AREAS THAT CURRENTLY PROVIDE A BARRIER FROM THE UNDERLYING SOILS (SUCH AS PAVED SIDEWALKS AND DRIVEWAYS) WOULD NOT REQUIRE REMEDIATION.

7.2.6 DISPOSAL

THE PROPOSED SITE FOR DISPOSAL OF CONTAMINATED RESIDENTIAL SOILS FOR ALL ALTERNATIVES IS THE PAGE PONDS TAILINGS IMPOUNDMENT. PAGE PONDS IS AN OLD TAILINGS IMPOUNDMENT THAT IS CURRENTLY THE SITE OF THE SOUTH FORK COEUR D'ALENE SEWER DISTRICT TREATMENT FACILITY. ON EITHER SIDE OF THE SEWAGE LAGOONS ARE "BENCHES THAT ARE PRIMARILY TAILINGS, DENUDED OF VEGETATION, AND CONSEQUENTLY ARE A SOURCE OF WINDBLOWN DUST TO THE VALLEY. THE BENCHES (EAST AND WEST DIKES) IS THE AREA RECOMMENDED FOR THE RESIDENTIAL SOILS REPOSITORY. CONSOLIDATION OF RESIDENTIAL SOIL AND SOD ONTO THE PAGE BENCHES WILL CONTRIBUTE TO REDUCING FUGITIVE WINDBLOWN DUST THROUGHOUT THE VALLEY.

SINCE THE VOLUME OF MATERIAL REQUIRING DISPOSAL WILL VARY WITH THE SELECTED ALTERNATIVE, THE VOLUME OF SOIL WASTES MAY EXCEED THE CAPACITY OF THE PAGE BENCHES. IN THAT CASE, AN ADDITIONAL DISPOSAL SITE WILL NEED TO BE USED TO SUPPLEMENT THE DISPOSAL CAPACITY OF PAGE PONDS SINCE THE APPROXIMATE CAPACITY OF PAGE PONDS IS 860,000 CUBIC YARDS.

THE DISPOSAL SITE WILL HAVE AN IMPERMEABLE CAP OR COVER (I.E., ONE THAT IS DESIGNED TO MINIMIZE MIGRATION OF CONTAMINANTS) PLACED DURING CLOSURE. THE LONG-TERM MANAGEMENT OF THE AREA WILL INCLUDE MAINTENANCE OF THE COVER AND GROUNDWATER MONITORING. IN ADDITION, ACCESS RESTRICTIONS AND LAND USE RESTRICTIONS AND/OR NOTICES WILL BE USED TO ENSURE THAT FUTURE USE OF THE PROPERTY IS NOT INCOMPATIBLE WITH A RESIDENTIAL SOILS REPOSITORY.

7.2.7 ENVIRONMENTAL MONITORING

REGARDLESS OF THE ALTERNATIVE SELECTED, CONTAMINATED MATERIALS WILL REMAIN WITHIN THE RESIDENTIAL AREAS OF THE SITE. ALTERNATIVE 6, WHICH REQUIRES DEEP EXCAVATION TO REMOVE MATERIALS, WILL MOST LIKELY NOT REMOVE ALL CONTAMINATED MATERIAL. THEREFORE, ENVIRONMENTAL MONITORING WILL BE CONTINUED AT THE SITE FOR AN INDEFINITE PERIOD. IT IS ESTIMATED THAT ENVIRONMENTAL MONITORING OF FUGITIVE DUST AND RESIDENTIAL SOIL AND LITTER WOULD CONTINUE. MONITORING WILL OCCUR AT PREVIOUS SAMPLING LOCATIONS TO PROVIDE A BASIS FOR HISTORICAL COMPARISONS. IT IS EXPECTED THAT BLOOD LEAD LEVELS WOULD ALSO BE MONITORED. FOR COST ESTIMATING PURPOSES, IT IS ASSUMED THAT A GREATER EXTENT AND FREQUENCY OF SAMPLING WILL BE REQUIRED IN ALTERNATIVE 5 THAN THE OTHER ALTERNATIVES, SINCE IT WOULD PLACE ONLY A SOD LAYER BARRIER BETWEEN THE CONTAMINANTS AND THE RESIDENTS.

7.3 ALTERNATIVE 3 -- VARIABLE CUT/REMOVE/FILL/DISPOSAL

ALTERNATIVE 3 CONSISTS OF THE FOLLOWING OPTIONS:

- ! A 2-INCH GRAVEL BARRIER AND 10-INCH COVER WITHOUT SOIL EXCAVATION
- ! A 2-INCH GRAVEL BARRIER INSTALLATION, AND A 10-INCH SOIL REPLACEMENT AFTER EXCAVATION AND REMOVAL OF UP TO 12 INCHES OF SOIL (YARDS WOULD BE ABOVE GRADE FOR EXCAVATIONS LESS THAN 12 INCHES)

BOTH OPTIONS ARE SIMILAR IN THAT EACH INCORPORATES A COMBINATION OF A VISUAL BARRIER AND A SEPARATE SOIL COVER. THEY DIFFER IN WHERE THEY CAN BE APPLIED TO A RESIDENTIAL YARD BECAUSE OF DRAINAGE AND HOME-OWNER CONSIDERATIONS. WHATEVER THE EXCAVATION DEPTH, THIS ALTERNATIVE WILL RESULT IN THE PLACEMENT OF A MINIMUM OF 12 INCHES OF CLEAN MATERIAL.

THE OPTION OF A GRAVEL/SOIL COVER BARRIER WITHOUT ADDITIONAL SOIL EXCAVATION IS PREFERRED BECAUSE IT MINIMIZES THE VOLUME OF CONTAMINATED SOIL REQUIRING DISPOSAL. A 2-INCH CLEAN GRAVEL LAYER WITH A 10-INCH SOIL COVER WOULD BE SELECTED FOR IMPLEMENTATION AT RESIDENCES IN WHICH THE FOUNDATION IS HIGH ENOUGH IN RELATION TO EXISTING GRADE TO ALLOW ITS USE, WHERE PERMISSION IS GRANTED BY THE RESPECTIVE PROPERTY OWNER, AND AT RESIDENCES WHERE DRAINAGE IS NOT A PROBLEM.

THE COVER WOULD CONSIST OF 2 INCHES OF CLEAN GRAVEL OVERLAIN BY 10 INCHES OF CLEAN TOPSOIL FROM AN OFFSITE BORROW SOURCE. THE GRAVEL LAYER WOULD PROVIDE A VISUAL AND PHYSICAL BARRIER INDICATING TO THE LANDOWNER THAT THE BOTTOM OF THE REMEDIATED SOILS HAD BEEN REACHED, ISOLATING THE UNDERLYING CONTAMINANTS FROM INADVERTENT EXPOSURE. ALSO, THE GRAVEL LAYER WOULD ACT TO SOME DEGREE AS A CAPILLARY BARRIER TO THE SUB-SURFACE MIGRATION OF METALS. CLEAN FILL WOULD BE REVEGETATED BY SODDING. TO THE EXTENT PRACTICABLE, THE YARD LANDSCAPING WOULD BE RETURNED TO ITS ORIGINAL CONDITION.

A 24-INCH LAYER OF TOPSOIL WOULD BE PLACED IN ESTABLISHED GARDEN AREAS SINCE SOME PLANT ROOTS AND TUBERS EXTEND BELOW 12 INCHES, BUT GENERALLY LESS THAN 24 INCHES. FUTURE ACTIVITIES THAT PENETRATE THE 12-INCH COVER, SUCH AS UTILITY LINE INSTALLATION, PLANTING OF LARGER TREES AND SHRUBS, AND BASEMENT OR FOUNDATION EXCAVATION, WOULD BE CONTROLLED THROUGH ORDINANCES REGULATING EXCAVATION, AS DETAILED UNDER SECTION 7.2.1, INSTITUTIONAL CONTROLS.

FOR THOSE RESIDENCES IN WHICH A SIMPLE GRAVEL BARRIER/SOIL COVERING CANNOT BE IMPLEMENTED, CONTAMINATED SOILS WOULD BE EXCAVATED AND REPLACED WITH A CLEAN GRAVE/TOPSOIL BARRIER. VARIOUS DEPTHS OF EXCAVATION AND FILL WOULD BE NECESSARY BASED ON SITE CONDITIONS:

- ! EXCAVATE 12 INCHES; REPLACE WITH 2 INCHES OF GRAVEL AND 10 INCHES OF SOIL
- ! EXCAVATE LESS THAN 12 INCHES; REPLACE WITH 2 INCHES OF GRAVEL AND 10 INCHES OF SOIL (FINISHED GRADE WOULD BE ABOVE EXISTING GRADES).
- ! EXCAVATE 24 INCHES, REPLACE WITH 2 INCHES OF GRAVEL AND 22 INCHES OF SOIL (FOR ESTABLISHED GARDEN AREAS).

THE CHOICE OF EXCAVATING TO LESS THAN 12 INCHES IS DEPENDENT UPON THE YARD GRADE IN RELATION TO THE HOUSE FLOOR GRADE AND DEPTH OF CONTAMINATION. UNDER MOST CIRCUMSTANCES, BUILDING CODES DO NOT ALLOW YARD GRADES TO BE HIGHER THAN HOUSE FLOOR GRADES. THE NEXT STEP TO IMPLEMENTING THIS ALTERNATIVE WOULD BE TO EXCAVATE SOILS TO THE SELECTED DEPTH BELOW THE GROUND SURFACE. ALL SOD OR OTHER SURFACE COVERINGS, EXCEPT FOR PAVEMENTS, WOULD BE REMOVED AND DISPOSED OF ALONG WITH THE SOIL. LARGE TREES (4-INCH DIAMETER AND LARGER) AND SHRUBS (TALLER THAN 3 FEET) WOULD BE SAVED, IF POSSIBLE. TREES AND SHRUBS LEFT IN PLACE WOULD BE TRIMMED BACK AND CONTAMINATED SOIL WOULD BE REMOVED BY HAND FROM AROUND THE ROOTS. THE "CLEAN" SOIL USED TO REPLACE THE EXCAVATED SOIL WOULD MEET BORROW SOURCE AND LANDSCAPING SPECIFICATIONS. BACKFILLED AREAS THAT WERE PREVIOUSLY LAWN AREAS WOULD GENERALLY BE REVEGETATED WITH SOD. IN SOME BACKFILLED AREAS IT MAY BE MORE APPROPRIATE TO REVEGETATE USING HYDROSEEDING WITH NATIVE GRASSES (STEEP HILLSIDES, VACANT LOTS, ETC). TO THE EXTENT PRACTICABLE, HOWEVER, THE YARD LANDSCAPING WOULD BE RETURNED TO ITS ORIGINAL CONDITION. THE VOLUME OF MATERIAL TO BE DISPOSED IS ESTIMATED TO BE 640,000 CUBIC YARDS.

REGARDLESS OF THE OPTION EMPLOYED UNDER ALTERNATIVE 3, ENVIRONMENTAL MONITORING OF FUGITIVE DUST, RESIDENTIAL SOILS, HOUSE DUSTS, AND PERIODIC BLOOD LEAD ANALYSES OF RESIDENTS WOULD BE CONTINUED. MONITORING WOULD OCCUR AT PREVIOUS SAMPLING LOCATIONS TO PROVIDE A BASIS FOR

HISTORICAL COMPARISON.

7.4 ALTERNATIVE 5 -- SOD REMOVAL/SOD REPLACEMENT/DISPOSAL

ALTERNATIVE 5 CONSISTS OF CONTAMINATED SOD REMOVAL AND REPLACEMENT.

RESIDENTIAL YARDS WOULD BE CLEARED AND GRUBBED, WHICH INCLUDES REMOVAL OF SOD, BRUSH, AND STUMPS. ALTERNATIVE 5 WOULD NOT INCLUDE ANY REMOVAL OF CONTAMINATED SOILS OR REPLACEMENT WITH CLEAN SOILS IN GRASSED AREAS. THE CLAN SOD WOULD BE PLACED OVER THE TOP OF CONTAMINATED SOILS. TO THE EXTENT PRACTICABLE, THE YARD LANDSCAPING WOULD BE RETURNED TO ITS ORIGINAL CONDITION.

ALL AREAS NOT TO BE COVERED WITH NEW SOD WOULD BE REMEDIATED USING EXCAVATE/REPLACE/DISPOSE TECHNIQUES. AREAS SUCH AS PLANTERS AND GRAVELED AREAS WOULD BE EXCAVATED TO 6 INCHES. GARDEN AREAS WOULD BE EXCAVATED TO 24 INCHES AND BACKFILLED WITH CLEANED SOIL, SIMILAR TO ALTERNATIVE 3. CONTAMINATED MATERIALS WOULD BE DISPOSED OF IN THE PAGE PONDS REPOSITORY. THE ESTIMATED VOLUME FOR DISPOSAL WOULD BE 203,500 CUBIC YARDS. CLEAN FILL FROM AN OFFSITE BORROW SOURCE WOULD BE USED TO REPLACE THE EXCAVATED MATERIALS.

FUTURE ACTIVITIES THAT PENETRATE THE CLEAN SOD LAYER, SUCH AS UTILITY LINE INSTALLATION, PLANTING OF TREES AND SHRUBS, AND BASEMENT OR FOUNDATION EXCAVATION, WOULD BE CONTROLLED THROUGH ORDINANCES REGULATING EXCAVATION, AS DETAILED UNDER SECTION 7.21, INSTITUTIONAL CONTROLS. ADDITIONAL INSTITUTIONAL CONTROLS WOULD HAVE TO BE IMPLEMENTED WITH ALTERNATIVE 5 TO MAINTAIN THE LONG-TERM VIABILITY OF THE SOD LAYER. THESE CONTROLS WOULD INCLUDE ORDINANCES REQUIRING HOMEOWNERS TO WATER AND MAINTAIN THE REPLACEMENT SOD TO AN ACCEPTABLE LEVEL. ADDITIONAL INSPECTION WOULD BE REQUIRED BY THE VARIOUS GOVERNMENT ENTITIES TO ENSURE THAT THE SOD MAINTENANCE ORDINANCES WERE EFFECTIVELY ENFORCED. A PROFESSIONAL LAWN MAINTENANCE COMPANY WOULD BE RETAINED TO ADVISE AND ASSIST THE HOMEOWNERS WITH PROPER SOD MAINTENANCE. THE LAWN MAINTENANCE COMPANY WOULD ALSO PROVIDE AND APPLY THE NECESSARY FERTILIZERS AND CHEMICALS TO ENSURE THE HEALTH AND VIGOR OF THE SOD BARRIER. ENVIRONMENTAL MONITORING AFTER REMEDIATION WOULD BE CONTINUED.

7.5 ALTERNATIVE 6 -- DEEP REMOVAL/FILL/DISPOSAL

ALTERNATIVE 6 INCLUDES REMOVAL OF CONTAMINATED SOIL TO A DEPTH OF 7 FEET AND REPLACEMENT WITH CLEAN MATERIAL. ALTHOUGH THIS IS A DEEP REMOVAL, THERE MAY BE CONTAMINANTS LEFT IN PLACE IN SOME AREAS.

THE INSTITUTIONAL CONTROLS REQUIREMENT WITH THIS ALTERNATIVE WOULD BE CONSIDERABLY REDUCED. SINCE CONTAMINATED RESIDENTIAL SOILS WOULD BE REMOVED TO A DEPTH OF 7 FEET, FUTURE INSTITUTIONAL CONTROLS FOR RESIDENTIAL YARDS WOULD BE MINIMIZED. THE PUBLIC INFORMATION AND HEALTH INTERVENTION PROGRAMS WOULD BE REQUIRED, BUT AT A REDUCED LEVEL. ENVIRONMENTAL MONITORING WOULD BE CONTINUED.

FOR RESIDENTIAL YARDS, ALL CONTAMINATED SOILS WOULD BE EXCAVATED AND REPLACED WITH CLEAN SOIL. THE DEPTH OF EXCAVATION WOULD BE DETERMINED ON A SITE-BY-SITE BASIS. THE EXCAVATION WOULD EXTEND TO A DEPTH AT WHICH THE THRESHOLD LEVEL WAS REACHED OR TO APPROXIMATELY 7 FEET.

PRIOR TO EXCAVATION ACTIVITIES, THE DEPTH AND CONCENTRATION OF LEAD CONTAMINATION WOULD BE DETERMINED IN AREAS TO BE REMEDIATED. SELECTION OF SAMPLING STRATEGY AND DEPTH OF SOIL REMOVAL WOULD BE A FUNCTION OF THE REMEDIAL DESIGN/REMEDIAL ACTION PROCESS.

ONCE EXCAVATION AND FILL DEPTHS ARE SELECTED, THE NEXT STEP TO IMPLEMENT THIS ALTERNATIVE WOULD BE EXCAVATE SOILS TO THE SELECTED DEPTH BELOW THE GROUND SURFACE. ALL SOD OR OTHER SURFACE COVERINGS WOULD BE REMOVED AND DISPOSED OF ALONG WITH THE SOIL. THE NEED TO REMOVE AND REPLACE

PAVEMENTS AND SIDE-WALKS WOULD BE DETERMINED ON A CASE-BY-CASE BASIS. ALL TREES AND SHRUBS WOULD BE REMOVED. THE SOIL USED TO REPLACE THE EXCAVATED SOIL WOULD CONSIST OF CLEAN SOIL FROM AN OFFSITE BORROW SOURCE. BACKFILLED AREAS WOULD BE REVEGETATED. TO THE EXTENT PRACTICABLE, THE YARD LANDSCAPING WOULD BE RETURNED TO ITS ORIGINAL CONDITION.

SOIL, SOD, AND OTHER MATERIALS THAT ARE REMOVED WOULD BE DISPOSED AT AN APPROPRIATE DISPOSAL SITE. IT IS ESTIMATED THAT ALTERNATIVE 6 WOULD GENERATE 4.45 MILLION CUBIC YARDS OF WASTES. PRELIMINARY ESTIMATES INDICATE THAT APPROXIMATELY 860,000 CUBIC YARDS OF WASTES COULD BE DISPOSED OF AT THE PAGE PONDS REPOSITORY. THIS MEANS THAT APPROXIMATELY 3.6 MILLION CUBIC YARDS OF WASTES WOULD HAVE TO BE DISPOSED OF AT ANOTHER SITE, IF ALTERNATIVE 6 IS IMPLEMENTED.

SPECIAL CARE WOULD HAVE TO BE TAKEN WHEN EXCAVATING NEAR FOUNDATIONS, BASEMENTS, AND UTILITIES TO AVOID DAMAGE TO EXISTING STRUCTURES AND FACILITIES. TEMPORARY SHORING AND SUPPORTS MAY BE REQUIRED. IT MAY BE ADVANTAGEOUS TO REMOVE AND REPLACE UTILITY LINES, RATHER THAN SHORE AND SUPPORT THEM DURING CONSTRUCTION.

BECAUSE OF THE INCONVENIENCE TO THE RESIDENTS AND POTENTIAL LIABILITIES ASSOCIATED WITH THIS ALTERNATIVE, THE RESIDENTS WOULD BE TEMPORARILY RELOCATED DURING CONSTRUCTION. THE RELOCATION WOULD BE TO LOCAL MOTELS OR HOTELS AND WOULD BE EXPECTED TO LAST 2 TO 3 WEEKS FOR AN AVERAGE RESIDENTIAL YARD REMEDIATION.

7.6 ALTERNATIVE 8 -- VARIABLE CUT/REMOVE/FILL/TREAT/DISPOSAL

ALTERNATIVE 8 IS IDENTICAL TO ALTERNATIVE 3 EXCEPT THAT THE EXCAVATED SOIL WOULD BE TREATED WITH POZZOLANIC AGENTS PRIOR TO DISPOSAL.

IN ALTERNATIVE 8, EXCAVATED SOILS WOULD BE MIXED WITH POZZOLANIC AGENTS IN A PUG MILL PRIOR TO DISPOSAL. THE ADDITION OF POZZOLANIC AGENTS WILL TEND TO SOLIDIFY CONTAMINATED SOILS AND MAY REDUCE CONTAMINANT MOBILITY.

IF THIS ALTERNATIVE IS CHOSEN, TREATABILITY STUDIES WOULD BE CONDUCTED TO DETERMINE IF THESE SOILS ARE AMENABLE TO POZZOLANIC FIXATION, AND IF POZZOLANIC FIXATION WILL ADEQUATELY REDUCE CONTAMINANT MOBILITY. ENVIRONMENTAL MONITORING WOULD BE CONTINUED AT PREDETERMINED INTERVALS. THE VOLUME OF MATERIAL TO BE DISPOSED WOULD INCREASE APPROXIMATELY 50 PERCENT FROM 640,000 CUBIC YARDS TO 960,000 CUBIC YARDS AS A RESULT OF POZZOLANIC TREATMENT.

#CAA

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

A COMPARATIVE ANALYSIS OF ALTERNATIVES USING EACH OF THE NINE EVALUATION CRITERIA, AS REQUIRED BY FEDERAL REGULATION, IS PRESENTED IN THIS SECTION. THE PURPOSE OF THIS ANALYSIS IS TO IDENTIFY THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE RELATIVE TO THE OTHER ALTERNATIVES. A SEPARATE EVALUATION OF THE ALTERNATIVES IS PRESENTED UNDER THE HEADING OF EACH CRITERION

8.1 PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT IS ADDRESSED TO VARYING DEGREES BY THE FIVE PROPOSED ALTERNATIVES. ALTERNATIVE 1 IS THE NO ACTION ALTERNATIVE. AS PROPOSED, IT WOULD HAVE NO EFFECT ON THE SITE; THEREFORE, IT DOES NOT ADDRESS ANY OF THE IDENTIFIED CONCERNS. INDEED, AN INCREASE IN BLOOD LEAD CONCENTRATIONS OVER TIME COULD OCCUR.

ALTERNATIVE 3, 6, AND 8 PROVIDE PROTECTION OF HUMAN HEALTH THROUGH INSTALLATION OF A SOIL AND SOD BARRIER BETWEEN RESIDENTS AND UNDERLYING CONTAMINATED MATERIALS. ALL THREE ADDRESS THE CONCERNS

OF EXPOSURE THROUGH DIRECT CONTACT WITH SOIL CONTAMINANTS OR TRACKING CONTAMINATED RESIDENTIAL SOIL INTO HOMES AS A SOURCE OF HOUSE DUST. ALTERNATIVE 5 ADDRESSES THESE CONCERNS, BUT TO A LESSER EXTENT THAN THE OTHERS BECAUSE OF THE REQUIREMENT FOR RIGOROUS MAINTENANCE ALL ALTERNATIVES ADDRESS THE EXPOSURE PATHWAY OF LOCAL GARDEN PRODUCE.

NONE OF THE ALTERNATIVES WOULD ALTER THE TOXICITY OR PERSISTENCE OF THE SOIL CONTAMINANTS. ALTERNATIVE 8 DOES INCLUDE A TREATMENT PLAN FOR EXCAVATED SOILS THAT WOULD SOLIDIFY THE SOILS ONCE THEY ARE REMOVED FROM THE SITE AND MAY REDUCE MOBILITY.

IN GENERAL, PERMANENCE OF REMEDIAL ACTIONS IS GREATEST FOR ALTERNATIVE 6 WITH ITS ESSENTIALLY COMPLETE REMOVAL OF CONTAMINATED SOILS. ALTERNATIVES 3 AND 8 PROVIDE A DEGREE OF PERMANENCE THROUGH REMOVAL OF SURFICIAL LAYERS OF CONTAMINANTS, REQUIRING LESS IMPLEMENTATION TIME AND EFFORT, BUT THEY RELY ON A GREATER NEED FOR INSTITUTIONAL CONTROLS. ALTERNATIVE 5 PROVIDES THE LEAST AMOUNT OF PROTECTION ON A PERMANENT LEVEL BECAUSE OF ITS RELIANCE ON INSTITUTIONAL CONTROLS AND THE SUSCEPTIBILITY OF THE SOD LAYER TO WITHSTAND NORMAL HUMAN ACTIVITIES AND INCONSISTENCIES IN MAINTENANCE.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

WITH THE EXCEPTION OF ALTERNATIVE 1, THE NO ACTION ALTERNATIVE, ALL ALTERNATIVES MEET FEDERAL AND STATE OF IDAHO ARARS. A FURTHER DISCUSSION OF COMPLIANCE WITH FEDERAL AND STATE ARARS IS INCLUDED IN CHAPTER 10.

8.3 LONG-TERM EFFECTIVENESS

THE RESIDUAL RISK (THE RISK REMAINING AFTER IMPLEMENTATION) INCREASES FROM LOWEST TO HIGHEST IN THE FOLLOWING ORDER OF ALTERNATIVES: 6,3 AND 8,5, AND 1 (NO ACTION ALTERNATIVE). ALTERNATIVE 6 WOULD RESULT IN THE LEAST AMOUNT OF RESIDUAL RISK BECAUSE OF THE VOLUME OF CONTAMINATED SOILS THAT WOULD BE REMOVED TO ENSURE THAT FUTURE EXPOSURE TO ONSITE RESIDENTIAL SOIL SOURCES DOES NOT OCCUR. ALTHOUGH ALTERNATIVES 3 AND 8 DO NOT REDUCE RESIDUAL RISK TO THE SAME LEVEL AS ALTERNATIVE 6, THEY WOULD PROTECT THE COMMUNITIES IN THE LONG TERM IF INSTITUTIONAL CONTROL MEASURES WERE IMPLEMENTED AND FOLLOWED. ALTERNATIVE 5 PROVIDES THE LEAST LONG-TERM PROTECTION SINCE THE SOD BARRIER MAY BE EASILY BREACHED.

MAINTENANCE REQUIREMENTS FOR ALL ALTERNATIVES WOULD BE FAIRLY SIMILAR. EACH ALTERNATIVE INCORPORATES A SOD OR GRASS COVER AND SIMILAR INSTITUTIONAL CONTROL. HOWEVER, THE LEVEL OF THE REQUIREMENT VARIES WITH THE ALTERNATIVE. ALTERNATIVE 5 IS MORE SENSITIVE TO MAINTENANCE REQUIREMENTS BECAUSE A LAYER OF SOD IS THE ONLY BARRIER BETWEEN RESIDENTS AND THE UNDERLYING CONTAMINATED SOILS. ALTERNATIVES 3 AND 8 FOLLOW WITH A LAYER OF CLEAN FILL OF AT LEAST' 12 INCHES UNDER THE SOD LAYER. ALTERNATIVE 6 REQUIRES THE LEAST AMOUNT OF MAINTENANCE AS A RESULT OF THE EXTENSIVE LAYER OF FILL (UP TO 7 FEET) NEEDED TO RETURN RESIDENTIAL YARDS TO THEIR ORIGINAL GRADE.

ENVIRONMENTAL MONITORING WOULD VARY ACCORDING TO THE DEGREE OF PROTECTIVENESS INCORPORATED WITHIN THE REMEDIAL ALTERNATIVES. ALTERNATIVE 5 WOULD REQUIRE THE GREATEST AMOUNT OF MONITORING TO ENSURE THAT THE SOD BARRIER REMAINS EFFECTIVE. THIS WOULD ENTAIL FREQUENT SOIL AND LITTER METALS ANALYSES AND BLOOD LEAD ANALYSES. ALTERNATIVES 3 AND 8 WOULD REQUIRE PERIODIC MONITORING OF THE SURFICIAL SOIL LAYER TO CHECK FOR AIRBORNE RECONTAMINATION AND PERIODIC MONITORING OF THE REMEDIATED SOIL PROFILE TO CHECK FOR DISRUPTION AND RECONTAMINATION OF THE SOIL BARRIER. ALTERNATIVES 3 AND 8 WOULD ALSO REQUIRE PERIODIC BLOOD LEAD ANALYSES. ALTERNATIVE 6 WOULD REQUIRE PERIODIC MONITORING OF THE SURFICIAL SOIL LAYER AND PERIODIC BLOOD LEAD ANALYSES. ALTERNATIVE 1 WOULD INCLUDE ENVIRONMENTAL MONITORING TO CHECK FOR CHANGES IN CONTAMINANT LEVELS WITH TIME. BLOOD LEAD SCREENING WOULD BE DISCONTINUED WHEN WARRANTED.

THE DISPOSAL RECOMMENDATION FOR RESIDENTIAL SOIL IS CONSISTENT FOR ALL ALTERNATIVES EXCEPT FOR ALTERNATIVE 8, WHICH INCLUDES THE ADDITION OF POZZOLANIC AGENTS PRIOR TO DISPOSAL. THE LONG-TERM EFFECTIVENESS OF THE DISPOSAL RECOMMENDATION IS ENSURED THROUGH APPROPRIATE CLOSURE REQUIREMENTS AND MANAGEMENT BY INSTITUTIONAL CONTROLS.

8.4 REDUCTION OF TOXICITY, MOBILITY, VOLUME, AND PERSISTENCE THROUGH TREATMENT

EACH ALTERNATIVE, WITH THE EXCEPTION OF THE NO ACTION ALTERNATIVE, REQUIRES VARYING DEGREES OF CONTAMINATED SOIL REMOVAL AND PLACEMENT OF A "CLEAN" FILL COVER TO CREATE A BARRIER BETWEEN UNDERLYING SOIL CONTAMINANTS AND THE RESIDENTIAL POPULATION. ALTERNATIVE 8 IS THE ONLY ALTERNATIVE TO INCORPORATE TREATMENT AS PART OF THE REMEDIAL ACTION. THIS TREATMENT WOULD SOLIDIFY THE EXCAVATED SOIL AND WOULD LIKELY REDUCE THE METALS MOBILITY FROM SOILS AT THE DISPOSAL AREA. THE ADDITIONAL DECREASE IN MOBILITY BY POZZOLANIC TREATMENT IS NOT KNOWN.

ALL ALTERNATIVES WOULD INCREASE VOLUME OF SOIL REMAINING WITHIN THE SUPERFUND BOUNDARIES THROUGH BULKING (10 TO 15 PERCENT OF THE IN-PLACE VOLUME). THE VOLUME WOULD INCREASE BY APPROXIMATELY 50 PERCENT AS A RESULT OF THE POZZOLANIC TREATMENT IN ALTERNATIVE 8 AS COMPARED TO ALTERNATIVE 3. NONE OF THE ALTERNATIVES PROPOSES TO CHANGE THE TOXICITY OR PERSISTENCE OF THE CONTAMINANTS.

8.5 SHORT-TERM EFFECTIVENESS

MOST OF THE REMEDIAL ACTIONS ARE SIMILAR IN THE TECHNOLOGIES PROPOSED FOR IMPLEMENTATION. THE EXTENT OF THE REMEDIAL ACTION VARIES CONSIDERABLY AMONG ALTERNATIVES. ALTERNATIVES 3,5, AND 8 ARE GENERALLY EQUIVALENT IN THE AMOUNT OF SHORT-TERM RISK THEY POSE TO THE COMMUNITY. EACH REQUIRES THE REMOVAL OF THE TOP VEGETATIVE LAYER AND VARYING AMOUNTS OF UNDERLYING SOIL. EACH ALTERNATIVE WOULD INCLUDE CONTINUING TO PRIORITIZE RESIDENTIAL YARDS ON THE BASIS OF SENSITIVE SUBPOPULATIONS. COMPLETION OF THESE ALTERNATIVES WOULD REQUIRE 4 TO 6 YEARS. ALTERNATIVE 6 WOULD REQUIRE CONSIDERABLY MORE TIME TO COMPLETE BECAUSE OF ITS SOIL REMOVAL REQUIREMENTS. EXPOSURE TO FUGITIVE DUST GENERATED BY THE REMEDIAL ACTIVITIES IS THE COMMON RISK SHARED BY EACH ALTERNATIVE. LOCALIZED RELEASES OF METALS-LADEN DUST WOULD LIKELY OCCUR DURING EXCAVATION, BUT SUCH RELEASES WOULD BE MINIMIZED BY DUST CONTROL TECHNIQUES. HOWEVER, NONE OF THE ACTION ALTERNATIVES IS EXPECTED TO SUBSTANTIALLY AFFECT THE COMMUNITIES DURING REMEDIATION.

ALTERNATIVE 6 WOULD CREATE A SLIGHTLY HIGHER RISK TO WORKERS AND RESIDENTS THAN THE OTHER ALTERNATIVES, MAINLY BECAUSE OF THE VOLUMES OF MATERIALS TO BE EXCAVATED AND MOVED AND THE DURATION OF TIME NEEDED TO ACCOMPLISH ALTERNATIVE 6. THE GREATER EXCAVATION VOLUME WOULD BE ASSOCIATED WITH INCREASED NOISE AND GREATER ANNOYANCE OF RESIDENTS FROM MORE CONSTRUCTION ACTIVITY. HEAVY EQUIPMENT TRAFFIC WOULD ALSO INCREASE ON LOCAL ROADS WITH IMPLEMENTATION OF ALTERNATIVE 6.

CONSTRUCTION CONTRACTORS WOULD NEED PROTECTION AGAINST DERMAL AND RESPIRATORY EXPOSURE TO THE DUST WHILE WORKING IN CONTAMINATED AREAS. PROTECTIVE CLOTHING AND RESPIRATORS OR DUST MASKS WOULD HELP CONTROL THIS RISK. THESE RISKS ARE INHERENT TO ALL ALTERNATIVES.

8.6 IMPLEMENTABILITY, RELIABILITY, AND CONSTRUCTIBILITY

IN GENERAL, THERE IS NOT A GREAT DIFFERENCE AMONG ALTERNATIVES IN THE TYPES OF REMEDIAL ACTIVITIES PROPOSED. THE EXTENT OR DEGREE TO WHICH THE REMEDIATION IS APPLIED DOES VARY SIGNIFICANTLY BETWEEN ALTERNATIVES. MOST OF THE ACTIVITIES PROPOSED AS PART OF THE ALTERNATIVES INCLUDING DISPOSAL ARE WELL-DEVELOPED TECHNOLOGIES. ALL OF THESE ACTIVITIES ARE TECHNICALLY FEASIBLE, BUT THE LEVEL OF EFFORT ASSOCIATED WITH EACH IS DIFFERENT.

ALTERNATIVE 5 IS THE MOST EASILY IMPLEMENTED ALTERNATIVE PROPOSED, REQUIRING ONLY THE REMOVAL AND REPLACEMENT OF A SOD AND GRASS LAYER. HOWEVER, ALTERNATIVE 5 WAS JUDGED TO BE THE LEAST

RELIABLE BECAUSE OF LACK OF DURABILITY AND DIFFICULTY IN IMPLEMENTING AND ENFORCING THE EXTENSIVE DATED INSTITUTIONAL CONTROLS REQUIREMENTS. ALTERNATIVE 6, HOWEVER, IS THE MOST DIFFICULT TO CONSTRUCT, REQUIRING REMOVAL OF UP TO 7 FEET OF SOIL AROUND EACH RESIDENCE, AND RESULTING IN POTENTIAL COMPLICATIONS ASSOCIATED WITH EXPOSED STRUCTURE FOOTINGS, UTILITY LINES, AND PIPES. BECAUSE OF THIS, ALTERNATIVE 6 HAS THE GREATEST POTENTIAL TO IMPACT THE COMMUNITY THROUGH CONSTRUCTION DELAYS RESULTING FROM COMPLICATIONS. ALTERNATIVES 3 AND 8 ARE IMPLEMENTABLE, RELIABLE, AND CONSTRUCTIBLE AND REQUIRE SLIGHTLY MORE COMPLEX ACTIVITIES THAN ALTERNATIVE 5, INVOLVING THE REMOVAL OF UP TO 12 INCHES OF SOIL AND THE VEGETATION LAYER WITH SUBSEQUENT REPLACEMENT OF AT LEAST 12 INCHES OF "CLEAN" SOIL AND A NEW SOD LAYER.

8.7 COST

THE COST COMPARISONS ARE STRAIGHTFORWARD. COMPARING PRESENT WORTH COSTS, ALTERNATIVE 6 IS THE MOST EXPENSIVE AND ALTERNATIVE 5 IS THE LEAST EXPENSIVE OF THE ACTION ALTERNATIVES. THE COSTS OF THE ACTION ALTERNATIVES, INCLUDING PRESENT WORTH, ARE LISTED IN TABLE 8-1.

8.8 STATE ACCEPTANCE

THIS DECISION DOCUMENT PRESENTS THE REMEDIAL ACTION SELECTED BY THE USEPA AND IDHW FOR THE POPULATED AREAS RESIDENTIAL SOILS OPERABLE UNIT AT THE BUNKER HILL MINING AND METALLURGICAL COMPLEX SITE IN NORTHERN IDAHO.

8.9 COMMUNITY ACCEPTANCE

USEPA AND IDHW SOLICITED INPUT FROM THE COMMUNITY ON THE CLEANUP METHODS PROPOSED FOR RESIDENTIAL SOILS. PUBLIC COMMENTS, IN GENERAL, INDICATED SUPPORT FOR THE RECOMMENDATION OF ALTERNATIVE 3 IN THE PROPOSED PLAN AND URGED AN EXPEDITIOUS IMPLEMENTATION OF THE PLAN. PUBLIC COMMENTS ARE SPECIFICALLY ADDRESSED IN THE RESPONSIVENESS SUMMARY SECTION OF THIS DOCUMENT AND SOME HAVE BEEN INCORPORATED INTO THE SELECTED REMEDY.

#SR

9.0 THE SELECTED REMEDY

9.1 INTRODUCTION

IDHW AND USEPA HAVE SELECTED ALTERNATIVE 3 (AS MODIFIED BY PUBLIC COMMENTS) AS THE REMEDY FOR CONTAMINATED RESIDENTIAL SOILS AT THE BUNKER HILL SITE. THIS SELECTION IS BASED ON THE ADMINISTRATIVE RECORD FOR THE SITE. THIS REMEDY ADDRESSES SURFICIAL RESIDENTIAL SOILS ONLY IN CURRENTLY ESTABLISHED RESIDENTIAL AREAS. BECAUSE OF THE EXTENT OF CONTAMINATION, BOTH AREAL AND AT-DEPTH, THIS REMEDY DOES NOT FOCUS ON COMPLETE REMOVAL OF CONTAMINATION FROM RESIDENTIAL YARDS, BUT FOCUSES ON CREATING A BARRIER BETWEEN CONTAMINANTS AND RESIDENTS. THE REMEDY EMPLOYS BOTH ENGINEERING AND INSTITUTIONAL CONTROLS TO CREATE AND MAINTAIN THE BARRIER.

9.2 RESIDENTIAL SOILS REMEDY

THIS REMEDY IS MADE UP OF THE FOLLOWING COMPONENTS:

SOIL SAMPLING

APPROXIMATELY 60 PERCENT OF RESIDENTIAL PROPERTIES HAVE BEEN SAMPLED AT THE 0-TO 1-INCH INTERVAL. PRIOR TO COMMENCEMENT OF REMEDIAL ACTION ON A SPECIFIC YARD, SAMPLING WILL BE REQUIRED AT THE 0- TO 1-, 1- TO 6-, 6- TO 12-, AND 12- TO 18-INCH INTERVALS. THE SAMPLING WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED SAMPLING PROCEDURES FOR THIS SITE INCLUDING ANALYSIS OF SOIL PASSING AN 80-MESH SCREEN FOR DETERMINATION OF THE 1,000 PPM THRESHOLD LEVEL.

REMOVAL/REPLACEMENT OF SOILS

THE REMOVAL OF CONTAMINATED SOIL AND SOD AND CONSEQUENT REPLACEMENT WITH COMPACTED CLEAN MATERIAL WILL BE CONDUCTED AS FOLLOWS:

IF THE 0-TO 1-INCH OR 1- TO 6-INCH-DEPTH INTERVALS EXCEED THE THRESHOLD LEVEL, 6 INCHES OF CONTAMINATED MATERIAL WILL BE EXCAVATED AND REPLACED. IN ADDITION, IF THE 6- TO 12-INCH INTERVAL EXCEEDS THE THRESHOLD LEVEL, ANOTHER 6 INCHES (TOTAL OF 12 INCHES) WILL BE REMOVED AND REPLACED. IF THE 6- TO 12-INCH INTERVAL DOES NOT EXCEED THE THRESHOLD LEVEL, THE PROPERTY WILL HAVE A 6-INCH EXCAVATION AND REPLACEMENT.

IN THE CASE WHERE THE 6- TO 12-INCH-DEPTH INTERVAL EXCEEDS THE THRESHOLD LEVEL BUT THE 0- TO 1-INCH AND 1- TO 6-INCH INTERVALS DO NOT, 12 INCHES OF MATERIAL WILL BE EXCAVATED AND REPLACED.

IF THE 0- TO 1-INCH AND THE 1- TO 6-INCH AND THE 6- TO 12-INCH INTERVALS DO NOT EXCEED THE THRESHOLD LEVEL THE PROPERTY WILL NOT BE REMEDIATED.

ALL PRODUCE GARDENS AREAS IN EVERY YARD WILL RECEIVE 24 INCHES OF CLEAN MATERIAL. CLEAN SOIL FOR PRODUCE GARDENS WILL BE MADE AVAILABLE TO RESIDENTS WHOSE YARDS DO NOT REQUIRE REMEDIATION.

IF EXISTING PROPERTY GRADES PERMIT, IT IS POSSIBLE THAT NO EXCAVATION OF RESIDENTIAL SOILS WOULD BE NECESSARY AND THE COVER MATERIAL COULD BE PLACED AND REVEGETATED WITHOUT EXCEEDING THE HEIGHT OF THE FOUNDATION. HOWEVER, IT IS MORE LIKELY THAT SOME CUT AND REMOVAL OF EXISTING SOIL WILL BE REQUIRED TO PROPERLY ACCOMMODATE THE CLEAN COVER AND NEW COVER AND NEW SOD.

FOR EACH RESIDENTIAL YARD, THE EXACT NATURE OF THE REMEDIATION (I.E., HOW MUCH SOD TO REPLACE, WHICH BUSHES TO REMOVE, ETC) WOULD HAVE TO BE CONSIDERED ON A CASE-BY-CASE BASIS. HOWEVER, FOR CONSISTENCY, THE FOLLOWING AREAS WOULD GENERALLY BE REMEDIATED WITHIN EACH YARD:

- ! SOD AREAS
- ! ROADWAY SHOULDERS (IF CURB AND GUTTER ARE NOT PRESENT) TO ASPHALT OR PAVEMENT AND TO THE LATERAL EXTENSION OF PROPERTY LINES
- ! ALLEYS (IF UNPAVED) TO THE EXTENSION OF THE LOT LINES
- ! LANDSCAPED AREAS
- ! GARDEN AREAS
- ! UNPAVED DRIVEWAYS
- ! GARAGES WITH DIRT FLOORS
- ! STORAGE AREAS

AREAS IMMEDIATELY ASSOCIATED WITH THE RESIDENTIAL PROPERTIES (I.E., ROAD SHOULDERS AND ALLEYS) WILL NOT REQUIRE TOP SOIL, BUT WILL REQUIRE REPLACEMENT WITH CLEAN MATERIAL IN KIND OR A PERMANENT COVER. ANY STEEP HILLSIDE AREAS LOCATED IMMEDIATELY ADJACENT TO YARDS AND WITH A SOIL LEAD CONCENTRATION GREATER THAN THE THRESHOLD LEVEL WILL BE STABILIZED AS PART OF THIS ACTION TO PREVENT RUNOFF AND RECONTAMINATION. THE FINAL REMEDY FOR THE HILLSIDES WILL BE ADDRESSED IN A SUBSEQUENT ROD.

BASED ON DOSE RESPONSE MODELING, A THRESHOLD LEVEL OF 1,000 PPM LEAD IN RESIDENTIAL SOIL WAS

DETERMINED TO BE THE THRESHOLD CLEANUP LEVEL MOST APPROPRIATE FOR THIS SITE. THE RESULTS OF THE THRESHOLD ASSESSMENT, AND THE ASSUMPTIONS USED, ARE SUMMARIZED IN TABLE 9-1.

REQUIREMENTS FOR REMOVAL AND REPLACEMENT OF SOILS ON AREAS ADJACENT TO RESIDENTIAL LOTS, SUCH AS VACANT RESIDENTIAL LOTS, WITHIN THE POPULATED AREAS WILL BE THE SAME AS FOR OCCUPIED PROPERTIES.

VISUAL MARKER

FOR RESIDENTIAL YARDS THAT REQUIRE EXCAVATION TO 12 INCHES, IF THE RESULTS OF SAMPLING IN THE 12- TO 18-INCH INTERVAL EXCEED THE THRESHOLD LEVEL, A VISUAL MARKER (SUCH AS EROSION CONTROL FABRIC OR OTHER SUITABLE MATERIAL) WILL BE PLACED PRIOR TO BACKILLING WITH CLEAN FILL.

REVEGETATION

DURING THE EXCAVATION PROCESS, ALL EXISTING SOD AND SOIL COVERINGS WILL BE REMOVED AND DISPOSED OF ALONG WITH THE SOIL. LARGER TREES AND SHRUBS WILL BE LEFT IN PLACE BUT SUBJECT TO PRUNING. AFTER SPREADING, COMPACTION, AND GRADING, CLEAN FILL WILL BE REVEGETATED. THE LAWN AREAS OF REMEDIATED YARDS WILL GENERALLY BE REVEGETATED WITH SOD. STEEP HILLSIDES AND OTHER REMEDIATED AREAS NOT CURRENTLY PLANTED WITH LAWNS (SUCH AS VACANT LOTS) WILL BE STABILIZED AND HYDROSEEDDED WITH NATIVE GRASSES. IF PREFERRED BY A PROPERTY OWNER, HYDROSEEDING WITH NATIVE GRASSES COULD BE SUBSTITUTED FOR THE SOD. VACANT LOTS WILL BE HYDROSEEDDED WITH NATIVE GRASSES AFTER REMEDIATION. TO THE EXTENT PRACTICABLE, ALL YARD LANDSCAPING WILL BE RETURNED TO ITS ORIGINAL CONDITION.

DUST SUPPRESSION

DUST SUPPRESSION MEASURES WILL BE IMPLEMENTED THROUGHOUT THE REMEDIATION PROCESS TO REDUCE EXPOSURE OF WORKERS AND RESIDENTS TO AIRBORNE CONTAMINANTS. DUST SUPPRESSION WILL INCLUDE, BUT NOT BE LIMITED TO:

- ! WATERING OF RESIDENTIAL YARD AREAS PRIOR TO EXCAVATION ACTIVITIES
- ! CONTINUED WATERING DURING EXCAVATION, AS NECESSARY
- ! PLACEMENT OF TARPS OR COVERS OVER EXCAVATED MATERIALS
- ! USE OF TARPS OR COVERS OVER TRUCK BEDS TO REDUCE BLOWING DUST AND SPILLAGE DURING TRANSPORTATION TO THE WASTER REPOSITORY
- ! DAILY CLEANUP OF ALL SPILLED OR TRACKED SOILS FROM SIDEWALKS, ROADWAYS, ETC.

DISPOSAL OF CONTAMINATED MATERIALS

THE ANALYSIS OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ASSOCIATED WITH THE DISPOSAL OF CONTAMINATED RESIDENTIAL SOILS ASSUMED THAT THE SOILS REPOSITORY WOULD BE LOCATED WITHIN THE BUNKER HILL SITE. IT IS RECOMMENDED THAT PAGE PONDS BE USED FOR THE DISPOSAL REPOSITORY BECAUSE IT HAS ADEQUATE VOLUME, IS WITHIN THE BUNKER HILL SITE, AND THE ACTION WILL REDUCE THE CONTAMINATED WINDBLOWN DUST ORIGINATING FROM THE PAGE PONDS AREA.

THE USE OF PAGE PONDS AS THE REPOSITORY WILL REQUIRE THAT IT BE CAPPED TO AIRBORNE CONTAMINANT MIGRATION AND REDUCE THE THREAT OF DIRECT CONTACT EXPOSURE. THE CAP SURFACE AREA WILL BE COMPACTED AND GRADED TO PREVENT PENDING AND MINIMIZE INFILTRATION; IT WILL ALSO BE VEGETATED FOR STABILIZATION AND MOISTURE ABSORPTION. ACCESS TO THE AREA WILL BE RESTRICTED BY FENCING, LOCKED GATES, AND WARNING SIGNS. FUTURE USE OF THE REPOSITORY WILL BE LIMITED AND SUBJECT TO INSTITUTIONAL CONTROLS.

IF PAGE PONDS IS NOT USED AS THE RESIDENTIAL SOIL REPOSITORY, THE CHOSEN REPOSITORY SITE WILL BE SUBJECT TO AGENCY EVALUATION AND PUBLIC NOTIFICATION.

INSTITUTIONAL CONTROLS

THE GOAL OF THE INSTITUTIONAL CONTROLS PROGRAM IS TO DEVELOP A FLEXIBLE SYSTEM THAT BUILDS ON EXISTING ADMINISTRATIVE STRUCTURES AND PROGRAMS RATHER THAN CREATE A NEW LAYER OF BUREAUCRACY. INSTITUTIONAL CONTROLS REGULATION WILL BE UNIFORM THROUGHOUT THE BUNKER HILL SITE, IRRESPECTIVE OF JURISDICTIONAL BOUNDARIES. THE INSTITUTIONAL CONTROLS ASSOCIATED WITH THIS ROD ARE DESIGNED FOR THE MAINTENANCE OF RESIDENTIAL SOIL BARRIERS ONLY. THESE CONTROLS ARE NECESSARY AND ARE AN INTEGRAL PART OF THE SELECTED REMEDY.

PHYSICAL PROGRAM REQUIREMENTS

PLANNING, ZONING, SUBDIVISION AND BUILDING PERMIT REGULATIONS: IMPLEMENTATION OF PLANNING, ZONING, AND SUBDIVISION CONTROLS THROUGH LOCAL ORDINANCES, DESIGNED TO PROTECT AND MAINTAIN BARRIERS WHEN DEVELOPMENT OR ANY ACTION THAT WOULD BREACH A BARRIER TAKES PLACE.

DISPOSAL OF UNEARTHED CONTAMINANTS: WHEN A BARRIER IS BROKEN, CONTAMINATED SOILS THAT ARE REMOVED MUST BE HANDLED TO MINIMIZE EXPOSURE, COLLECTED FOR DISPOSAL, AND TRANSPORTED TO A PROPER DISPOSAL SITE. A MEANS FOR DISPOSAL OF INCIDENTAL CONTAMINATED SOILS WILL BE PROVIDED TO RESIDENTS.

PROVISION OF CLEAN SOIL: A PROGRAM WILL BE IMPLEMENTED TO PROVIDE A CENTRALLY LOCATED SUPPLY OF CLEAN REPLACEMENT SOIL (BOTH FILL AND TOPSOIL) TO FACILITATE BARRIER REPAIR, MAINTENANCE, AND ESTABLISHMENT OF PRODUCE GARDEN AREAS.

ADMINISTRATIVE PROGRAM REQUIREMENTS

COORDINATION OF PUBLIC INSTITUTIONS: EFFECTIVE ADMINISTRATION OF A UNIFORM INSTITUTIONAL CONTROLS PROGRAM WILL REQUIRE SHARED AUTHORITY AND RESOURCES. THE FOUR CITIES AND SHOSHONE COUNTY WILL PLAY AN IMPORTANT ROLE THROUGH ALREADY ESTABLISHED PERMITTING PROCEDURES. IT HAS BEEN RECOMMENDED THAT THE PANHANDLE HEALTH DISTRICT WILL ADMINISTER THE EFFORT WITH PERMITTING, INSPECTION, RECORDS MAINTENANCE, AND ENACTMENT OF REGULATIONS, WHERE NECESSARY, ACROSS JURISDICTIONAL BOUNDARIES.

DEED NOTICES: THESE ARE A METHOD TO NOTIFY NEW OWNERS OF THEIR BARRIER SYSTEM AND THEIR RESPONSIBILITY FOR PARTICIPATION IN THAT SYSTEM.

EDUCATIONAL PROGRAMS: EDUCATIONAL PROGRAMS WILL BE DEVELOPED TO KEEP INFORMATION ABOUT THE BARRIER SYSTEM IN THE PUBLIC EYE AND TO HELP THE PUBLIC RECOGNIZE WHEN DISRUPTION OF THE BARRIER SYSTEMS REQUIRES ATTENTION OR CAUTION. DISTRIBUTION OF INFORMATION SHOULD BE PROVIDED THROUGH PAMPHLETING, BROCHURES, AND GENERAL MEDIA EXPOSURE.

PERMITTING AND INSPECTION PROCEDURES: PERMIT ISSUANCE AND RECORD KEEPING PROCEDURES SHOULD BE TAILORED TO MINIMIZE INCONVENIENCE TO PERMIT APPLICANTS. A PERMIT SYSTEM THAT INTEGRATES WITH EXISTING PERMIT ROUTINES WILL BE IMPLEMENTED.

MONITORING AND HEALTH SURVEILLANCE PROGRAMS: MONITORING WILL BE REQUIRED TO ASSURE BOTH PROGRAM PERFORMANCE AND EFFECTIVENESS. HEALTH INTERVENTION EFFORTS WILL BE REQUIRED TO DOCUMENT AND ASSESS SUCCESS IN ACHIEVING REMEDIAL GOALS AND OBJECTIVES.

AN EVALUATION OF INSTITUTIONAL CONTROLS FOR THE POPULATED AREAS OF THE BUNKER HILL SUPERFUND SITE OUTLINES THE VARIOUS OPTIONS ASSOCIATED WITH EACH OF THE INSTITUTIONAL CONTROL REQUIREMENTS AND WILL BE USED IN THE REMEDIAL DESIGN PHASE TO GUIDE IMPLEMENTATION OF THE PROGRAM. THE IMPLEMENTATION PHASE, REFERRED TO AS PHASE II, WILL INCLUDE PASSING LOCAL ORDINANCES, SETTING UP AN ADMINISTRATIVE SYSTEM TO OVERSEE AND RUN THE PROGRAM, AND DOCUMENTATION OF DETAILED

PROCEDURES FOR EACH OF THE PROGRAM COMPONENTS.

MONITORING

THE EFFECTIVENESS OF THE INSTITUTIONAL CONTROLS PROGRAM WILL BE EVALUATED PERIODICALLY. APPROPRIATE AIR MONITORING WILL BE CONDUCTED TO IDENTIFY THE OCCURRENCE OF CONTAMINANT MIGRATION DURING REMEDIAL ACTIVITIES. ANY EXCEEDANCES OF THE STANDARDS WILL RESULT IN IMMEDIATE IMPLEMENTATION OF ADDITIONAL DUST SUPPRESSION MEASURES OR A SHUT DOWN OF CONSTRUCTION ACTIVITIES.

SINCE CONTAMINATED MATERIAL WILL BE LEFT ONSITE, BOTH IN POPULATED AND NON-POPULATED AREAS, ONGOING MONITORING OF FUGITIVE DUST AND RESIDENTIAL YARDS IS NECESSARY TO ENSURE THAT THE CLEAN BARRIER IS MAINTAINED.

9.3 CHANGES TO PROPOSED PLAN

DURING THE PUBLIC COMMENT PERIOD, SEVERAL ISSUES WERE RAISED CONCERNING THE PREFERRED ALTERNATIVE IN THE PROPOSED PLAN; CONSEQUENTLY, SEVERAL MINOR MODIFICATIONS HAVE BEEN INCORPORATED INTO THE SELECTED REMEDY IN RESPONSE TO THOSE CONCERNS. THE FOLLOWING IS A LIST OF THOSE MODIFICATIONS:

- ! DEPTH OF EXCAVATION MAY BE VARIABLE (LESS THAN 12 INCHES) DEPENDING ON DEPTH OF CONTAMINATION.
- ! FOR THOSE PROPERTIES REQUIRING A VISUAL MARKER, IT WILL BE A MATERIAL THAT CAN BE EASILY SEEN DURING DIGGING OR EXCAVATION ACTIVITIES. THE VISUAL MARKER DOES NOT HAVE TO BE A 2-INCH GRAVEL LAYER.
- ! REQUIREMENTS FOR DISPOSAL SITE CLOSURE INCLUDED A IMPERMEABLE CAP TO PROTECT GROUNDWATER. ARARS ASSOCIATED WITH GROUNDWATER AND SURFACE WATER PROTECTION WILL BE ADDRESSED IN A SUBSEQUENT FS AND ROD.
- ! THE SCOPE OF THE INSTITUTIONAL CONTROLS PROGRAM WILL BE REEVALUATED PERIODICALLY BECAUSE THE REQUIREMENTS OF A PROGRAM OF THIS NATURE MAY CHANGE WITH TIME.
- ! SOIL WILL BE PROVIDED FOR HOMEOWNERS WHO HAVE A SOIL LEAD LEVEL LESS THAN 1,000 BUT WHO WANT A GARDEN.

9.4 COST

COST EVALUATIONS, INCLUDING THE ASSUMPTIONS USED, ARE PRESENTED IN THE FEASIBILITY STUDY. SUMMARY OF THE CAPITAL COSTS ASSOCIATED WITH THE SELECTED ALTERNATIVE IS SHOWN IN TABLE 9-2. THE COSTS ARE ORDER-OF-MAGNITUDE (+50 PERCENT TO -30 PERCENT) ESTIMATES. CAPITAL COSTS ARE THOSE REQUIRED TO INITIATE AND CONSTRUCT THE REMEDIAL ACTION. TYPICAL CAPITAL COSTS INCLUDE CONSTRUCTION EQUIPMENT, LABOR AND MATERIALS EXPENDITURES, ENGINEERING, AND CONSTRUCTION MANAGEMENT. BID AND SCOPE CONTINGENCIES ARE INCLUDED IN THE TOTAL CAPITAL COST. PROJECTED ANNUAL OPERATION AND MAINTENANCE COSTS FOR THE SELECTED REMEDY ARE ALSO PRESENTED IN TABLE 9-2. THESE COSTS ARE NECESSARY TO ENSURE THE CONTINUED EFFECTIVENESS OF A REMEDIAL ACTION. INCLUDED ARE SUCH ITEMS AS LABOR AND MATERIALS; MONITORING AND THE INSTITUTIONAL CONTROLS PROGRAM; AND INSURANCE, TAXES, ETC.

THE FEASIBILITY LEVEL COST ESTIMATES SHOWN HAVE BEEN PREPARED FOR GUIDANCE IN PROJECT EVALUATION AND IMPLEMENTATION FROM THE INFORMATION AVAILABLE AT THE TIME OF THE ESTIMATE. THE FINAL COSTS

OF THE PROJECT WILL DEPEND ON ACTUAL LABOR AND MATERIAL COSTS, ACTUAL SITE CONDITIONS, PRODUCTIVITY, COMPETITIVE MARKET CONDITIONS, FINAL PROJECT SCOPE AND SCHEDULE, AND OTHER VARIABLE FACTORS. AS A RESULT, THE FINAL PROJECT COSTS WILL VARY FROM THE ESTIMATES PRESENTED HERE.

PRESENT WORTH COSTS ARE CALCULATED USING A 5 PERCENT DISCOUNT RATE AND A 30-YEAR ESTIMATED PROJECT LIFE. THE PRESENT WORTH COST FOR THE SELECTED REMEDY IS \$40.6 MILLION (TABLE 9-2). CAPITAL COSTS AND LONG-TERM ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS ARE INCLUDED IN THE TOTAL PRESENT WORTH COST. LONG-TERM O&M COSTS ARE THOSE ASSOCIATED WITH MAINTAINING AN ALTERNATIVE AFTER IMPLEMENTATION IS COMPLETE.

COSTS PRESENTED IN TABLE 9-2 ARE LOWER THAN THOSE PRESENTED IN THE RESIDENTIAL SOIL FEASIBILITY STUDY OR THE PROPOSED PLAN. THE REDUCTION IN COST IS ASSOCIATED WITH CHANGES TO THE PROPOSED PLAN AS PRESENTED IN SECTION 9.3. SPECIFICALLY, REMOVING THE REQUIREMENT FOR AN IMPERMEABLE CAP ACCOUNTS FOR THE COST REDUCTION.

9.5 PERFORMANCE REQUIREMENTS

A REMEDIAL ACTION OBJECTIVE FOR THIS OPERABLE UNIT IS TO DECREASE THE EXPOSURE TO LEAD-CONTAMINATED RESIDENTIAL SOILS SUCH THAT 95 PERCENT OR MORE OF THE CHILDREN IN THE AREA HAVE BLOOD LEAD LEVELS BELOW 10 UG/DL AND THAT LESS THAN 1 PERCENT HAVE BLOOD LEADS GREATER THAN 15 UG/DL. THE FORMER IS PROJECTED TO BE ACHIEVED BY REDUCING THE OVERALL SOIL AND DUST LOADING CONCENTRATION TO 700 TO 1,200 PPM. THE 1,000 PPM YARD SOIL THRESHOLD CLEANUP LEVEL WILL REDUCE MEAN YARD SOIL CONCENTRATIONS TO APPROXIMATELY 200 TO 300 PPM IN RESIDENTIAL AREAS. IN COMBINATION WITH OTHER REMEDIAL MEASURES AND THE POSITIVE EFFECTS LIKELY TO BE SEEN IN OTHER MEDIA, IT IS EXPECTED THAT THIS OBJECTIVE WILL BE MET. ACHIEVING THE LATTER OBJECTIVE OF LESS THAN 1 PERCENT OF AREA CHILDREN WITH BLOOD LEAD CONCENTRATIONS BELOW 15 UG/DL IS LESS DEPENDENT ON THE MEAN SOIL/DUST CONCENTRATIONS THAN ON THE SOIL CONCENTRATION LEFT IN AN UNREMIEDIATED YARD. A CHILD LIVING ON AN UNREMIEDIATED YARD OF 1,000 PPM IS ESTIMATED TO HAVE A 0.1 TO 2.5 PERCENT (DEPENDING ON VARIOUS ASSUMPTIONS) CHANCE OF EXCEEDING 15 UG/DL BLOOD LEAD IN THE BUNKER HILL POST-REMEDICATION ENVIRONMENT. ANY HIGHER THRESHOLD CLEANUP LEVEL WOULD RESULT IN UNACCEPTABLE RISK TO THAT CHILD. IT IS EXPECTED THAT THIS GOAL WILL BE ACHIEVED BY REPLACING ALL RESIDENTIAL YARDS WITH A LEAD CONCENTRATION GREATER THAN 1,000 PPM LEAD WITH CLEAN MATERIAL (LESS THAN 100 PPM). THIS EXPECTATION ASSUMES THAT FUGITIVE DUST SOURCES WILL BE CONTROLLED AND HOUSE DUST CONCENTRATIONS WILL CONSEQUENTLY DECREASE AND THAT REMEDIATED YARDS WILL NOT BE RECONTAMINATED.

THIS REMEDY MITIGATES THE RISKS ASSOCIATED WITH THE FOLLOWING PATHWAYS IDENTIFIED IN THE RISK ASSESSMENT:

- ! INHALATION/INGESTION OF CONTAMINATED RESIDENTIAL SOIL
- ! INGESTION OF LOCALLY GROWN PRODUCE

THIS REMEDY DOES NOT DIRECTLY ADDRESS THE RISKS ASSOCIATED WITH THE FOLLOWING PATHWAYS IDENTIFIED IN THE RISK ASSESSMENT:

- ! CONSUMPTION OF CONTAMINATED GROUNDWATER
- ! INHALATION/INGESTION OF WINDBLOWN DUST
- ! INALATION/INGESTION OF CONTAMINATED HOUSE DUST

ACTIONS ARE BEING TAKEN NOW TO ADDRESS THESE RISKS. THE FINAL REMEDIATION WITH RESPECT TO THESE RISKS WILL BE ADDRESSED IN A SUBSEQUENT FEASIBILITY STUDY.

#SD

10.0 STATUTORY DETERMINATION

THE SELECTED REMEDY FOR RESIDENTIAL SOILS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, WILL COMPLY WITH FEDERAL AND STATE REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE, AND IS COST EFFECTIVE. THE SELECTIVE REMEDY DOES UTILIZE ALTERNATIVE TREATMENT AND RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. HOWEVER, SINCE NO TREATMENT AND RESOURCE RECOVERY TECHNOLOGIES WERE FOUND TO BE PRACTICABLE, MORE WERE INCORPORATED INTO THE REMEDY. BECAUSE THIS REMEDY WILL RESULT IN HAZARDOUS SUBSTANCES REMAINING ONSITE ABOVE HEALTH-BASED LEVELS, THE 5-YEAR REVIEW PROVISIONS OF CERCLA SECTION 121C WILL APPLY TO THIS ACTION. THE FOLLOWING SECTIONS DISCUSS HOW THE SELECTED REMEDY MEETS THE STATUTORY REQUIREMENTS.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

LEAD ABSORPTION AMONG YOUNG CHILDREN IS THE MOST SIGNIFICANT HEALTH RISK POSED BY THIS SITE. RESIDENTIAL SOILS WERE IDENTIFIED IN THE RADER TO BE ONE OF THE PRIMARY CONTRIBUTORS TO RISK ASSOCIATED WITH SUBCHRONIC LEAD ABSORPTION. IN ORDER TO REDUCE BLOOD LEAD EXPOSURES, THE SELECTED REMEDY REPLACES METAL-CONTAMINATED RESIDENTIAL SOILS WITH UNCONTAMINATED SOIL, THEREBY BREAKING THE EXPOSURE PATHWAY BETWEEN SOILS AND CHILDREN. POST-REMEDATION MODELING SCENARIOS SHOW THAT THE SOIL CLEANUP LEVEL OF 1,000 PPM WILL RESULT IN A SITEWIDE MEAN BLOOD LEAD LEVEL OF 2.7 TO 3.9 UG/DL. ONLY 1 TO 3 PERCENT OF THE CHILDREN LIVING ONSITE ARE PREDICTED TO HAVE BLOOD LEAD LEVELS IN EXCESS OF 15 UG/DL. IT IS EXPECTED THAT AT LEAST 95 PERCENT WILL HAVE A BLOOD LEAD LEVEL LESS THAN 10 UG/DL.

INCLUSION OF PRODUCE GARDEN AREA REMEDIATION TO A DEPTH OF 24 INCHES WILL ALSO REDUCE THE EXPOSURE TO CADMIUM, LEAD, AND ZINC ASSOCIATED WITH CONSUMPTION OF LOCAL GARDEN PRODUCE.

THE REMEDY SELECTION WILL ALSO EFFECTIVELY MITIGATE CHRONIC NONCARCINOGENIC RISKS ASSOCIATED WITH INGESTION OF ANTIMONY, CADMIUM, AND MERCURY VIA SOIL INGESTION. CARCINOGENIC RISKS ASSOCIATED WITH ARSENIC AND CADMIUM EXPOSURE THROUGH FUGITIVE DUST WILL BE ADDRESSED UNDER A SEPARATE OPERABLE UNIT.

CONTAMINATED RESIDENTIAL SOILS WILL BE CONSOLIDATED IN A PERMANENT REPOSITORY. ALL CONSOLIDATION AREAS WILL BE PROTECTED FROM EROSION AND SURFACE INFILTRATION BY A REVEGETATED TOPSOIL CAP AND CONTOURING. EXPERIENCE WITH RESIDENTIAL SOIL REMOVAL ACTIONS DURING 1989 AND 1990 INDICATE THAT WITH APPROPRIATE PRECAUTIONS THERE WILL BE NO UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS ASSOCIATED WITH THE IMPLEMENTATION OF THE SELECTED REMEDY.

THE INSTITUTIONAL CONTROLS PROGRAM WILL ENSURE THE MAINTENANCE OF PHYSICAL AND INSTITUTIONAL BARRIERS THAT PROTECT AGAINST METAL EXPOSURE. CONTINUED BLOOD LEAD AND RESIDENTIAL SOILS MONITORING WILL MEASURE THE LONG-TERM SUCCESS OF THE SELECTED REMEDY.

HOUSE DUST HAS ALSO BEEN IDENTIFIED AS A SIGNIFICANT LEAD EXPOSURE PATHWAY. RESIDENTIAL SOILS ARE A CONTAMINANT SOURCE TO HOUSE DUST. THUS, REMEDIATING RESIDENTIAL SOILS WILL REDUCE A CONTAMINATION PATHWAY TO HOME INTERIORS. FUGITIVE DUST WILL NEED TO BE CONTROLLED AND MONITORED CONCOMITANT WITH RESIDENTIAL SOIL REMEDIATION TO MINIMIZE SOIL RECONTAMINATION. THE RADER DISCUSSES THE RATE OF SOIL RECONTAMINATION FROM AIRBORNE FUGITIVE DUST AND RECOMMENDS THAT AIR BORNE DUST BE REDUCED SUBSTANTIALLY. CONTROL OF FUGITIVE DUST WILL ALSO ELIMINATE DIRECT EXPOSURE TO HIGHLY CONCENTRATED DUSTS, REDUCE ACCUMULATION OF METALS IN HOMES, AND PREVENT EXCESSIVE DEPOSITION ON HOMEGROWN PRODUCE IN LOCAL GARDENS. DUST CONTROL MEASURES HAVE BEEN TAKEN ON THE SITE IN THE PAST TWO YEARS. THESE MEASURES INCLUDE IRRIGATION OF THE CENTRAL IMPOUNDMENT AREA (CIA) REVEGETATION OF SOME OF THE BUREAU OF LAND MANAGEMENT (BLM) PROPERTY ON

SMELTERVILLE FLATS, PLACEMENT OF LARGE ROCKS ON BARREN AREAS NORTH OF THE KELLOGG MIDDLE SCHOOL, AND SPREADING OF SAWDUST ON THE SMELTERVILLE FLATS AREA. CONTROL OF FUGITIVE DUST FROM BARREN HILLSIDES IS BEING ADDRESSED IN THE HILLSIDE REVEGETATION ORDER PREVIOUSLY DISCUSSED. ADDITIONAL DUST CONTROL MEASURES WILL BE IMPLEMENTED BY THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) UNDER THE JULY 1991 ADMINISTRATIVE ORDER ON CONSENT (SEE SECTION 2.5).

THE ANALYSIS PRESENTED IN THE RADER AND THE FS SHOWS THAT THE REMEDY SELECTED FOR RESIDENTIAL SOILS WILL BREAK THE SIGNIFICANT EXPOSURE PATHWAYS ASSOCIATED WITH SOIL. ONCE RESIDENTIAL SOIL REMOVAL IS COMPLETED, WASTE SOIL WILL BE CONSOLIDATED WITHIN THE AREA CONTAMINATION OF THE BUNKER HILL SITE, AND AN INSTITUTIONAL CONTROLS PROGRAM IS IMPLEMENTED, RISKS ASSOCIATED WITH METAL-CONTAMINATED RESIDENTIAL SOILS WILL BE MITIGATED. THEREFORE, LDHW AND USEPA HAVE CONCLUDED THAT THE SELECTED REMEDY FOR RESIDENTIAL SOILS WILL BE PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

PURSUANT TO SARA SECTION 121(D) REMEDIAL ACTIONS SHALL ATTAIN A DEGREE OF CLEANUP OF HAZARDOUS SUBSTANCES, POLLUTANTS, AND CONTAMINANTS RELEASED IN TO THE ENVIRONMENT AND CONTROL OF FURTHER RELEASE WHICH, AT A MINIMUM, ASSURES PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. IN ADDITION, REMEDIAL ACTIONS SHALL, UPON THEIR COMPLETION, REACH A LEVEL OR STANDARD OF CONTROL FOR SUCH HAZARDOUS SUBSTANCES, POLLUTANTS, OR CONTAMINANTS WHICH AT LEAST ATTAINS LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE FEDERAL STANDARDS, REQUIREMENTS, CRITERIA, OR LIMITATIONS, OR ANY PROMULGATED STANDARDS, REQUIREMENTS, CRITERIA, OR LIMITATIONS UNDER A STATE ENVIRONMENTAL OR FACILITY SITING LAW THAT IS MORE STRINGENT THAN ANY FEDERAL STANDARD (ARARS). ALL ARARS WOULD BE MET BY THE SELECTED REMEDY.

THE FEDERAL AND STATE ARARS IDENTIFIED BY USEPA AND IDHW, RESPECTIVELY FOR RESIDENTIAL SOIL REMOVAL ARE PRESENTED IN TABLES 10-1 THROUGH 10-6. AN EVALUATION OF CHEMICAL, LOCATION, AND ACTION-SPECIFIC ARARS IS PRESENTED IN SECTION 2 OF THE RESIDENTIAL SOIL FEASIBILITY STUDY. ADDITIONAL DISCUSSION OF CHEMICAL-SPECIFIC ARARS AND OTHER REQUIREMENTS TO BE CONSIDERED (TBCS) IS PRESENTED IN SECTION 3 OF THE RADER.

THERE ARE CURRENTLY NO PROMULGATED LAWS OR STANDARDS FOR LEAD IN SOIL. HOWEVER, A SITE-SPECIFIC THRESHOLD LEVEL OF 1,000 PPM LEAD IN RESIDENTIAL SOIL, THAT IS EXPECTED TO RESULT IN A COMMUNITY AVERAGE OF 200 TO 300 PPM, HAS BEEN DEVELOPED FOR PROTECTION OF HUMAN HEALTH.

FOR THE BUNKER HILL RESIDENTIAL SOILS ACTION, CONTAMINATED RESIDENTIAL SOIL WILL BE CONSOLIDATED FROM YARDS THROUGHOUT THE SITE INTO A SINGLE LOCATION. SINCE SOME RESIDENTIAL SOILS DID DEMONSTRATE RCRA HAZARDOUS CHARACTERISTICS FOR LEAD AND PESTICIDES (CHLORDANE), AN ANALYSIS OF THE APPLICABILITY OR RELEVANCE AND APPROPRIATENESS OF THE RCRA HAZARDOUS WASTES REGULATIONS IS REQUIRED:

FOR RCRA TO BE APPLICABLE, THE MATERIAL MUST DEMONSTRATE HAZARDOUS CHARACTERISTICS, AND THE PROPOSED ACTION MUST INVOLVE EITHER TREATMENT, STORAGE, OR DISPOSAL OF THE MATERIAL AS DEFINED BY RCRA. AS THE REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS HAS SHOWN, RESIDENTIAL PROPERTIES AND ALL OTHER AREAS WITHIN THE BUNKER HILL SUPERFUND SITE ARE CONTAMINATED TO VARIOUS DEGREES WITH LEAD AND OTHER HEAVY METALS. CONTAMINATION IS CONTIGUOUS THROUGHOUT THE SITE AND THE SITE IS CONSIDERED A SINGLE "AREA OF CONTAMINATION" (AOC). AS DESCRIBED IN THE PREAMBLE TO THE FINAL NCP, MOVEMENT OF WASTES AND SOIL WITHIN AN AOC AT A SUPERFUND SITE DOES NOT CONSTITUTE DISPOSAL OR "PLACEMENT" AND THEREFORE DOES NOT TRIGGER RCRA, SUBTITLE C, DISPOSAL REQUIREMENTS. FOR THIS ACTION, ALL SOIL CONSOLIDATION AND MOVEMENT WILL BE WITHIN A SINGLE AOC; THUS, THE RCRA REQUIREMENTS ARE NOT APPLICABLE.

FOR RCRA TO BE RELEVANT AND APPROPRIATE, THE RCRA REQUIREMENTS MUST ADDRESS PROBLEMS OR

SITUATIONS THAT ARE SIMILAR TO THE ACTION BEING TAKEN AND THE REQUIREMENTS MUST BE WELL SUITED TO THE SITE. USEPA HAS DETERMINED THAT PORTIONS OF THE RCRA CLOSURE REQUIREMENTS ARE RELEVANT AND APPROPRIATE FOR THIS ACTION.

CLOSURE REQUIREMENTS ADDRESS WHAT ACTIONS ARE NECESSARY TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT WHEN THE DISPOSAL ACTION IS COMPLETE. FOR THIS ACTION, THE RELEVANT AND APPROPRIATE CLOSURE REQUIREMENTS INCLUDE: 1) CAPPING TO MINIMIZED AIRBORNE CONTAMINANT MIGRATION AND REDUCE THE THREAT OF DIRECT CONTACT EXPOSURE; 2) LONG-TERM MANAGEMENT OF THE DISPOSAL SITE, INCLUDING COVER MAINTENANCE AND GROUNDWATER MONITORING; AND 3) INSTITUTIONAL CONTROLS SUCH AS ACCESS RESTRICTIONS, LAND USE RESTRICTIONS, AND/OR DEED NOTICES.

CLOSURE REQUIREMENTS AND LANDFILL DESIGN AND OPERATING REQUIREMENTS WITH RESPECT TO GROUNDWATER AND SURFACE WATER PROTECTION WILL BE ADDRESSED IN A SUBSEQUENT ROD.

RCRA MINIMUM TECHNOLOGY REQUIREMENTS ARE NOT APPROPRIATE FOR THIS ACTION BECAUSE THE RESIDENTIAL SOILS DO NOT PRESENT HAZARDS THAT WARRANT SECURE DISPOSAL.

REQUIREMENTS OF THE LAND DISPOSAL RESTRICTIONS ARE NOT APPROPRIATE FOR THIS REMEDIAL ACTION BECAUSE THE MATERIAL WILL BE MOVED WITHIN THE AOC. PLACEMENT, AS DEFINED BY RCRA, WILL NOT OCCUR.

IF PAGE PONDS IS NOT USED AS THE RESIDENTIAL SOILS REPOSITORY, THE AGENCIES WILL CONDUCT AN EVALUATION OF ARARS SPECIFIC TO THE REPOSITORY SITE CHOSEN.

IDHW AND USEPA HAVE DETERMINED THAT ALL STATE AND FEDERAL ARARS FOR RESIDENTIAL SOILS REMOVAL AND REPLACEMENT WILL BE MET BY THE SELECTED REMEDY. THE AGENCIES HAVE NOT DETERMINED THE ARARS WITH RESPECT TO GROUNDWATER AND SURFACE WATER PROTECTION AS PART OF THIS OPERABLE UNIT ROD. THAT DETERMINATION WILL BE MADE IN A SUBSEQUENT ROD.

10.3 COST-EFFECTIVENESS

IDHW AND USEPA BELIEVE THE SELECTED REMEDY IS COST-EFFECTIVE IN MITIGATING THE RISK POSED BY CONTAMINATED RESIDENTIAL SOILS. SECTION 300.430(F)(II)(D) OF THE NATIONAL CONTINGENCY PLAN (NCP) REQUIRES AN EVALUATION OF COST-EFFECTIVENESS BY COMPARING ALL THE ALTERNATIVES THAT MEET THE THRESHOLD CRITERIA (PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT) AGAINST THREE ADDITIONAL BALANCING CRITERIA (LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT; AND SHORT-TERM EFFECTIVENESS). THE SELECTED REMEDY MEETS THESE CRITERIA AND PROVIDES OVERALL EFFECTIVENESS IN PROPORTION TO ITS COST.

THE SELECTED REMEDY INCLUDES REMOVING AND REPLACING CONTAMINATED SOILS (OR PLACING A SOIL CAP, WHERE APPROPRIATE), INSTALLING VISUAL BARRIERS (WHERE APPLICABLE), REVEGETATING, SUPPRESSING DUST DURING REMEDIATION, DISPOSING OF CONTAMINATED MATERIALS, AND MONITORING FOR METALS IN SOIL. INSTITUTIONAL CONTROLS WILL ENSURE LONG-TERM MAINTENANCE OF PHYSICAL AND INSTITUTIONAL BARRIERS THAT PROTECT AGAINST METALS EXPOSURE. THIS ALTERNATIVE IS ATTRACTIVE BECAUSE OF THE RELATIVELY LOW COST (APPROXIMATELY \$41.3 MILLION PRESENT WORTH) AND EXPECTED EFFECTIVENESS, AS COMPARED WITH OTHER ALTERNATIVES.

THE PRINCIPAL DIFFERENCE BETWEEN THE SELECTED REMEDY AND TWO OF THE OTHER ALTERNATIVES IS EXCAVATION DEPTH. ONE ALTERNATIVE INVOLVES SOD EXCAVATION AND REPLACEMENT WITHOUT REMOVAL OF UNDERLYING CONTAMINATED SOILS. ALTHOUGH LESS EXPENSIVE THAN THE SELECTED REMEDY, SOD REMOVAL AND REPLACEMENT WOULD PROVIDE A LESS EFFECTIVE MEANS OF PROTECTING HUMAN HEALTH AND THE ENVIRONMENT. ANOTHER ALTERNATIVE, WHICH REQUIRED A 7-FOOT EXCAVATION DEPTH, WAS CONSIDERED EXCESSIVE. ALTHOUGH AN EXCAVATION DEPTH OF 7 FEET WOULD EFFECTIVELY REMOVE THE CONTAMINATED

RESIDENTIAL SOILS, THE ASSOCIATED COST OF \$193 MILLION WAS SUBSTANTIALLY HIGHER THAN THAT FOR THE SELECTED REMEDY. THE ADDED REMEDIAL EFFECTIVENESS WOULD BE MARGINAL WITH RESPECT TO THE ADDITIONAL COST.

AN ALTERNATIVE WITH A POZZOLANIC TREATMENT PRIOR TO DISPOSAL WAS ALSO EVALUATED. POZZOLANIC TREATMENT WOULD BE INTENDED TO REDUCE THE MOBILITY OF CONTAMINANTS, AS COMPARED WITH UNTREATED CONTAMINATED SOIL. HOWEVER, THE REDUCTION IN CONTAMINANT MOBILITY IS EXPECTED TO BE MARGINAL WITH RESPECT TO THE ADDITIONAL COST OF \$14.7 MILLION. CONTAMINANTS IN UNTREATED SOILS WOULD BE ADEQUATELY IMMOBILIZED WHEN DISPOSED IN A REVEGETATED AND PROPERLY CONTOURED LANDFILL. THE SELECTED ALTERNATIVE WAS THEREFORE DETERMINED TO BE MORE COST-EFFECTIVE.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

IDHW AND USEPA BELIEVE THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR RESIDENTIAL SOILS AT THE BUNKER HILL SITE. OF THE ALTERNATIVES PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND THAT COMPLY WITH ARARS, THE SELECTED REMEDY PROVIDES THE BEST BALANCE IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY, VOLUME, AND PERSISTENCE; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; AND COST. ALSO, THE SELECTED REMEDY CONSIDERS THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT AND CONSIDERS COMMUNITY ACCEPTANCE.

LONG-TERM EFFECTIVENESS WAS THE PRIMARY REASON FOR SELECTING ALTERNATIVE 3 OVER ALTERNATIVE 5. TWELVE INCHES OF SOIL AND SOD PROVIDE A MUCH MORE PERMANENT PHYSICAL BARRIER TO POTENTIAL EXPOSURE THAN SIMPLY A SOD BARRIER. THE INSTITUTIONAL CONTROLS ASSOCIATED WITH ALTERNATIVE 3 IMPROVED COMMUNITY ACCEPTANCE BECAUSE THE CONTROLS ARE LESS INTRUSIVE COMPARED TO ALTERNATIVE 5. THE COST OF REMOVING SOILS TO A DEPTH OF 7 EET IN ALTERNATIVE 6 WAS TOO HIGH COMPARED TO ALTERNATIVE 3, CONSIDERING THE ASSOCIATED INCREMENTAL IMPROVEMENT IN PERMANENCE.

THE SELECTED REMEDY DOES UTILIZE ALTERNATIVE TREATMENT AND RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. TREATMENT OF RESIDENTIAL SOILS WAS NOT FOUND TO BE PRACTICABLE; THEREFORE, THIS REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT THE COMBINATION OF HIGH SOIL VOLUME, THE NATURE OF METAL CONTAMINATION, AND THE NEED TO EXCAVATE SOILS FROM YARDS PRIOR TO APPLICATION OF A TREATMENT TECHNOLOGY LIKE SOIL WASHING MADE THE COSTS OF ANY KNOWN TREATMENT TECHNOLOGY, WHETHER PROVEN OR UNPROVEN, PROHIBITIVE. AN INSITU SOIL TREATMENT PROCESS WOULD HAVE ELIMINATED THE SOIL HANDLING REQUIREMENT. HOWEVER, FIXATION OR POZZOLANIC TREATMENTS ARE NOT CONSISTENT WITH THE USES OF A RESIDENTIAL YARD. THERE ARE NO OTHER IN SITU TREATMENT TECHNOLOGIES KNOWN TO BE EFFECTIVE IN REMOVING METALS FROM SOIL.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

FOR THE REASONS DESCRIBED ABOVE, THE SELECTED REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT. HOWEVER, THIS ENGINEERING CONTROL/CONTAINMENT REMEDY IS CONSISTENT WITH THE SUPERFUND PROGRAM EXPECTATIONS STATED IN THE NCP (40 CFR 430(A)(1)(III)(B)).

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TABLE 5-2
RESIDENTIAL PROPERTIES WITH LEAD CONCENTRATIONS
ABOVE 1,000 PPM LEAD

LOCATION	ESTIMATED TOTAL NUMBER OF PROPERTIES	PROPERTIES GT 1,000 PPM LEAD (PERCENT)
KELLOGG	1,320	89
WARDNER	181	69
SMELTERVILLE	303	88
PAGE	77	37
PINEHURST	837	20
TOTAL	2,718	65 (AVG.)

LOCATION	APPROXIMATE NUMBER OF PROPERTIES GT 1,000 PPM LEAD
KELLOGG	1,175
WARDNER	125
SMELTERVILLE	267
PAGE	28
PINEHURST	167
TOTAL	1,762

NOTES:

1. THE ESTIMATED TOTAL NUMBER OF PROPERTIES TO BE REMEDIATED INCLUDES VACANT LOTS WITHIN EXISTING RESIDENTIAL AREAS.
2. THE APPROXIMATE NUMBER OF RESIDENTIAL PROPERTIES WERE CALCULATED USING DATA FOR SAMPLES COLLECTED FROM APPROXIMATELY 50 PERCENT OF THE TOTAL RESIDENCES.
3. INFORMATION PRESENTED IN THIS TABLE WAS TAKEN FROM THE RISK ASSESSMENT DATA EVALUATION REPORT (RADER) FOR THE BUNKER HILL POPULATED AREAS AND TERRA GRAPHICS. TWO HUNDRED AND TWENTY-ONE OF THESE RESIDENTIAL PROPERTIES HAVE ALREADY BEEN REMEDIATED UNDER THE 1989/1990 PHASED CLEANUP.
4. THE NUMBER OF PROPERTIES PRESENTED FOR KELLOGG INCLUDES RESIDENCES IN ROSS RANCH AND ELIZABETH PARK.

TABLE 6-4

NONCARCINOGENIC EFFECTS AND ASSOCIATED RFDS
FOR SITE CONTAMINANTS OF CONCERN

CHEMICAL	EXPOSURE ROUTE	PATHOLOGY	RFD (MG/KG-DAY)
ANTIMONY	ORAL	GI IRRITATION	4 X (10-4)
ARSENIC	ORAL	SKIN LESIONS	1 X (10-3)
CADMIUM	ORAL	RENAL DYSFUNCTION	
		FOOD	1 X (10-3)
		WATER	5 X (10-4)
COPPER	ORAL	GI IRRITATION	1.3 MG/L
LEAD	INHALATION AND ORAL	VARIOUS, INCLUDING RENAL DYSFUNCTION, ANEMIA AND NEUROBEHAVIORAL DEFICIENCIES	UNAVAILABLE
MERCURY	ORAL	RENAL DYSFUNCTION	3 X (10-4)
ZINC	ORAL	ANEMIA	0.20

CHEMICALS WITH COMMON EFFECTS INCLUDE: CADMIUM, LEAD, AND MERCURY FOR RENAL TOXICITY

LEAD AND ZINC FOR ANEMIA.

ANTIMONY AND COPPER FOR PRODUCTION OF GASTROINTESTINAL (GI) IRRITATION.

RESULTS OF THE CHRONIC EXPOSURE AND RISK CHARACTERIZATION INDICATE THAT EXCESS (ABOVE BACKGROUND) CARCINOGENIC RISK IS ASSOCIATED WITH BASELINE EXPOSURES AND CONSEQUENT INTAKES FOR ARSENIC AND CADMIUM IN AIR. TOTAL BASELINE (70-YEAR LIFETIME) RISK TO LUNG CANCER, DUE TO INHALATION OF ARSENIC AND CADMIUM UNDER CURRENT SITE CONDITIONS, IS FROM 2 TO 32 TIMES GREATER THAN FOR OFFSITE BACKGROUND. UNDER THE HISTORICAL SCENARIO, RISK TO LUNG CANCER WAS TWO TO SIX TIMES GREATER THAN THE CURRENT SCENARIO FOR THE SAME COMMUNITIES. BASELINE CANCER RISK ESTIMATES INDICATE THAT THE TYPICAL POPULATION EXCEEDS USEPA'S ACCEPTABLE RANGE FOR CANCER RISK (10^{-4}) TO (10^{-6}).

ACCEPTABLE LEVELS OF RISK TO LUNG CANCER MAY NEVER BE ATTAINED AT ANY FUTURE ARSENIC AND CADMIUM AIR LEVELS FOR THOSE INDIVIDUALS WHO HAVE HAD CONSIDERABLE HISTORICAL AND CUMULATIVE EXPOSURES. TUMOR REGISTRY DATA SUPPORT THE PRESENCE OF A DISEASE-CAUSING AGENT FOR THE INCREASED OCCURRENCE OF RESPIRATORY CANCERS IN THE AREA.

BASELINE CARCINOGENIC RISK DUE TO SITE EXPOSURES IS APPROXIMATELY 30 PERCENT GREATER THAN BACKGROUND CARCINOGENIC RISK 9.8×10^{-4} . BASELINE CARCINOGENIC RISK IN CONJUNCTION WITH THE CONSUMPTION OF SITE GROUNDWATER IN SMELTERVILLE AND KELLOGG DUE TO ARSENIC INTAKES COULD RESULT IN A DOUBLING OF THE RISK ASSOCIATED WITH BACKGROUND EXPOSURES. EXCESS HEALTH RISK DUE TO ARSENIC IN GROUNDWATER MAKES THIS SOURCE UNSUITABLE FOR DRINKING IN MANY AREAS OF THIS SITE. GROUNDWATER IS NOT CURRENTLY USED AS A MUNICIPAL DRINKING WATER SOURCE.

TABLE 6-5 PRESENTS A SUMMARY OF THE BASELINE AND INCREMENTAL CARCINOGENIC RISK ESTIMATES.

TABLE 8-1

SUMMARY OF ESTIMATED COSTS

ALTERNATIVE	CAPITAL COST	ANNUAL OPERATION & MAINTENANCE COST
ALTERNATIVE 3 \$41,300,000 12-INCH REMOVAL/ REPLACEMENT	\$34,200,000	\$460,000
ALTERNATIVE 5 \$28,600,000 SOD LAYER REMOVAL/ REPLACEMENT	\$14,400,000	\$792,000
ALTERNATIVE 6 \$193,000,000 DEEP EXCAVATION/ REPLACEMENT	\$189,000,000	\$257,000
ALTERNATIVE 8 \$56,000,000 12-INCH REMOVAL/ REPLACEMENT AND POZZOLANIC TREATMENT	\$48,900,000	\$460,000
ALTERNATIVE	PRESENT WORTH COST	
ALTERNATIVE 3 12-INCH REMOVAL/REPLACEMENT		\$ 41,300,000
ALTERNATIVE 5 SOD LAYER/REPLACEMENT		28,600,000
ALTERNATIVE 6 DEEP EXCAVATION/REPLACEMENT		193,000,000
ALTERNATIVE 8 12-INCH REMOVAL/REPLACEMENT AND POZZOLANIC TREATMENT		56,000,000

TABLE 9-2

SUMMARY OF ESTIMATED COSTS FOR SELECTED REMEDY

ITEM	CAPITAL COST (\$)	ANNUAL O&M COST (\$)
OCCUPIED LOTS REMEDIATION TOTAL	18,502,000	0
VACANT LOTS REMEDIATION TOTAL	3,665,223	0
DISPOSAL CAP	599,078	0
OPERATIONS AND MAINTENANCE	0	400,209
HEALTH AND SAFETY (10 PERCENT)	2,276,630	0
DIVISION 1 COSTS (8 PERCENT)	1,821,304	0
ENGINEERING SERVICES (10 PERCENT)	2,821,304	0
SUBTOTAL	29,140,865	400,209
15 PERCENT CONTINGENCY	4,371,130	60,031
TOTAL CAPITAL COST	33,500,000	460,000
TOTAL O&M PRESENT WORTH	7,100,000	
TOTAL PRESENT WORTH	40,600,000	

NOTES:

1. DIVISION 1 COSTS INCLUDE THE COSTS FOR GENERAL CONDITIONS, MOBILIZATION, PERMITS, BONDS, AND INSURANCE.
2. THE "OCCUPIED LOTS REMEDIATION TOTAL" IS BASED ON REMEDIATION OF 1,273 RESIDENCES.
3. THE "VACANT LOTS REMEDIATION TOTAL" IS BASED ON REMEDIATION OF 268 VACANT RESIDENTIAL LOTS.
4. THE PRESENT WORTH WAS CALCULATED USING A DISCOUNT RATE OF 5 PERCENT FOR 30 YEARS, THEN ROUNDED TO THREE SIGNIFICANT FIGURES.
5. INSTITUTIONAL CONTROL COSTS INCLUDE PERSONNEL, BENEFITS, CONTRACTUAL SERVICES, SUPPLIES AND MATERIALS, CAPITAL EQUIPMENT, HEALTH INTERVENTION PROGRAM, SOIL COLLECTION PROGRAM, AND MATERIAL SUPPLY PROGRAM REQUIRED FOR ANNUAL MAINTENANCE OF REMEDIAL ACTIONS.
6. THE DISPOSAL CAP WAS ASSUMED TO BE A 1-FOOT SOIL CAP.